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ATTORNEY DOCKET NO: 82223-202

EXAMINER	Shengjun Wang
ART GROUP	1617
APPLICANT	Lorraine Mignault
SERIAL NO:	09/762,232
FILED	August 4, 1999
FOR	Topical Lotion Containing Oatstraw

Commissioner of Patents
Washington, D.C., 20231
U.S.A.

Dear Sir:

Responsive to the Notice of Non-Compliant Appeal Brief dated August 18, 2006 and the telephone call from the USPTO in late September, a replacement/supplemental appeal brief is attached hereto wherein:

It is believed that all of the defects noted by the USPTO have been corrected. The assistance provided by the clerk is greatly appreciated.

We hereby authorize you to charge a two month late fee of $225 (if due) for filing this supplemental brief in support to our Deposit Account No: 01-0310. In the event that any other additional fees are required, you are hereby authorized to charge or credit any additional fees to our deposit account 01-0310.

Respectfully submitted

LORRAINE MIGNAULT

PER: _____
Michael R. Williams
Registration No: 45,333

November 6, 2006

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Dear Sir:

APPEAL BRIEF

The following Appeal Brief is presented in Appeal of the Final Rejection of the Examiner dated November 17, 2004 and the Advisory Action before the Filing of an Appeal Brief dated March 9, 2005 and subsequent to the Notice of Appeal filed May 11th, 2005. This Appeal Brief sets out all of the requirements under 37CFR 41.37(c) as follows:

1. *Real Party of Interest*

The party of interest is Lorraine Mignault.

2. *Related appeals and interferences*

There are no related appeals and interferences.

3. *Status of Claims*

Claims 1, 5-9, 17-20, 22, 24-26 and 30 stand rejected and are the subject of this Appeal.

Claims 2-4, 10-16, 21, 23 and 27-29 have been previously cancelled.

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4. *Status of Amendments*

Subsequent to the issue of the Final Rejection, a further response was filed which contained no amendments to the claims. It is therefore believed that there

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are no unentered amendments so that the claims presented herein are as set for the hereinafter.

5. *Summary of Claimed Subject Matter*

Claim 1

The number of features set forth in this claim are as follows:

Claim 1 describes a topical lotion for relieving pain, swelling or inflammation which comprises glycerine; lavender oil; and oatstraw extract, wherein the oatstraw extract is prepared by magnetically treating water, heating the magnetically treated water, steeping oatstraw in the heated water and filtering the steeped oatstraw to remove oatstraw particles.

Support for claim 1 may be found at least on page 1, lines 17-21, page 7, lines 6-17 and page 8, lines 3-21. It is noted that the terms 'magnetized' and 'magnetically treated' are used interchangeably in the art, as discussed in prior responses.

Claim 8

Claim 8 describes a method of treating pain, swelling, itching or inflammation wherein the above-described lotion is applied topically to inflamed, painful or swollen areas.

Support for claim 8 may be found at least on page 2, lines 10-16, page 6, lines 21-24, page 7, lines 6-17, and page 8, lines 10-21.

Claim 17

Claim 17 describes an additive comprised of at least 50% oatstraw extract, the oatstraw extract prepared by magnetically treating water, heating the magnetically treated water, steeping oatstraw in the heated water and filtering the steeped oatstraw to remove oatstraw particles, at least 25% glycerine, and 0.1-0.2% lavender oil and a suitable carrier.

Support for this claim may be found at least on page 4, lines 1 to 16, page

5, lines 1 to 23, page 7, lines 6-17, page 9, line 21 to page 11, line 3.

Claim 18

Claim 18 describes a hair or body product comprising: at least 50% oatstraw extract, the oatstraw extract prepared by magnetically treating water, heating the magnetically treated water, steeping oatstraw in the heated water and filtering the steeped oatstraw to remove oatstraw particles, at least 25% glycerine, and 0.1-0.2% lavender oil and a suitable carrier.

Support for this claim may be found at least on page 4, lines 1 to 16, page 5, lines 8 to 23, page 7, lines 6 to 17, and page 9, line 21 to page 10, line 17.

Claim 20

Claim 20 describes a process for preparing an oatstraw extract comprising magnetically treating a quantity of water, heating the magnetically treated water, steeping a quantity of oatstraw in the heated water, thereby producing an oatstraw mixture and then filtering the mixture to remove the oatstraw, thereby producing an oatstraw extract.

Support for this claim may be found at least on page 5, line 24 to page 6, line 15 and page 7, lines 6 to 17.

Claim 25

Claim 25 describes a topical lotion for relieving pain, swelling or inflammation having an active ingredient consisting of oatstraw extract, the oatstraw extract is prepared by magnetically treating water, heating the magnetically treated water, steeping oatstraw in the heated water and filtering the steeped oatstraw to remove the oatstraw, wherein the lotion is applied topically to the skin of an individual in need thereof.

Support for claim 1 may be found at least on page 1, lines 17-21, page 7, lines 6-17 and page 8, lines 3-21.

Claim 26

Claim 26 is directed to an additive having an active ingredient consisting of oatstraw extract, the oatstraw extract is prepared by magnetically treating water, heating the magnetically treated water, steeping oatstraw in the heated water and filtering the steeped oatstraw, wherein the additive is added to another product.

Support for this claim may be found at least on page 4, lines 1 to 16, page 5, lines 1 to 23, page 7, lines 6-17, page 9, line 21 to page 11, line 3.

It is believed to be simplest to define a summary of the invention in terms of the claims as follows:

The invention relates to an oatstraw extract and methods of preparation and use of same.

The invention involves steeping the oatstraw in heated water.

The above features are well known to anyone skilled in the art and the following features distinguish the invention from the prior art:

Specifically, an oatstraw extract is prepared by:

magnetically treating water (page 7, lines 7-8),

heating the magnetically treated water,

steeping oatstraw in the heated water and

filtering the steeped oatstraw to remove oatstraw particles (page 7, lines 15-17).

Removal of the oatstraw particles from the steeped oatstraw is not explicitly taught by the prior art. This feature distinguishes the invention from the prior art in that the removal of the oatstraw particles allows the extract to be used as a topical lotion and as an additive in other products, thereby improving the properties of these products.

The invention is further distinguished from the prior art by the preparation of the oatstraw extract in magnetically treated or magnetized water. The combination of oatstraw extract in magnetically treated water has surprising properties, for example, improved efficacy of application, absorption and feel compared to extracts prepared in tap water or deionized water.

6. *Grounds of Rejection to be Reviewed*

Whether Claims 1, 5-9, 17-20, 22, 24-26 and 30 are unpatentable under 35 U.S.C. 103 over the prior cited patents of Weed in view of Puchalski, Jr. et al. and Jakobson et al., in further view of Ito, or Patrasenko et al.

The Examiner concluded that while "Weed does not expressly teach to make water extract of oatstraw as herein claimed, or the addition of glycerin and lavender oil", Puchalski teaches a polyol to enhance skin feel and Jakobson teaches the addition of lavender oil. Regarding "magnetically treated water", the Examiner has stated that "the employment of magnetically treated water for preparing therapeutical composition would have been obvious in view of Ito or Patrasenko [which] teach magnetic treatment provide cleaner water".

It is believed that the rejection under 35 USC 103 should be reversed for the following reasons:

1) There is no incentive to combine the cited references, as discussed above. Specifically, there is no indication in the combination of references of the desirability of preparing an aqueous oatstraw extract in magnetically treated water or the improved absorptive properties thereof.

2) As discussed above, even if combined, the cited art does not lead to applicant's invention.

3) The examiner's analysis of Weed is contrary to MPEP 2141 (B) and (C) in that the examiner is not considering the reference in its entirety and is also reading the reference in hindsight.

4) No references have been cited which teach or suggest filtering of an aqueous oatstraw suspension.

5) The submitted affidavits regarding the surprising properties of an oatstraw extract in magnetically treated water have not been given sufficient weight, contrary to MPEP 716.02 (b) and MPEP 716.01 (c).

6) Contrary to MPEP 2144, the use of magnetically treated water as a feature of the claims has not been properly considered.

Grouping of Claims

The Applicant presents the following groups of claims for consideration:

Group 1---Claims 1, 5, 6 and 7. It is accepted that Claims 5, 6 and 7 will stand or fall with Claim 1.

Group 2---Claims 8, 9 and 24. It is accepted that claims 9 and 24 will stand or fall with Claim 8.

Group 3---Claim 17.

Group 4---Claims 18 and 19. It is accepted that claim 19 will stand or fall with claim 18.

Group 5---Claims 20 and 22. It is accepted that claim 22 will stand or fall with Claim 20.

Group 6---Claim 25.

Group 7---Claims 26 and 30. It is accepted that claim 30 will stand or fall with claim 26.

7. *Argument*

In the Advisory Action dated March 9, 2005 and the Final Action dated November 17, 2004, the Examiner has set out his position concerning the rejections of Claims 1, 5-9, 17-20, 22, 24-26 and 30. Specifically, these claims were rejected under 35 USC 103(a) over Weed in view of Puchalski, Jr. and Jakobson, in further view of Ito or Patrasenko.

DISCUSSION OF PRIOR ART

Applicant notes that Weed teaches a plurality of uses for oatstraw, one of which is the addition of dried oatstraw or pulverized oatstraw directly to bath water in which the body part(s) to be soaked are then immersed. Weed is emphatic regarding the presence of the oatstraw within this bath, stating that the bath must contain "the oats and all" (Weed, page 205). Thus, Weed teaches that the beneficial properties of solubilized oatstraw, that is, of an oatstraw suspension, are short-lived and that the oats must be present within the water in order for benefits to be enjoyed. Weed does not

teach or suggest that other compounds may be added to the oatstraw suspension or that the oatstraw may be mixed with other compounds. Weed also does not teach or suggest adding oatstraw to bath or shower products.

The examiner has previously taken the position that the most relevant sections of Weed to applicant's invention are as follows:

On page 200, Weed describes the preparation of an infusion: *"oatmeal made into a cake with water, baked and browned like coffee, then pulverized and made into a coffee or infusion"*. The pulverized infusion is strained to remove large particles.

On page 205, Weed teaches soaking feet in "strained oatstraw infusion" or soaking in a bathtub prepared by *"boil[ing] water and pour[ing] over oatstraw in a large tub. When cooled sufficiently, bathe. (Yes, with the oats and all.)"*

Puchalski teaches a shampoo and bath or shower gel composed of several different components, which may include a humectant and/or emollient, which **may** be glycerine (US Patent 4,690,818, column 2, lines 37-45).

Jakobson teaches a polyglycerol fatty acid ester mixture for use as a bath additive which **may** include lavender oil (US Patent 5,397,497, column 5, lines 11-21) which is listed as one of a number of oils having therapeutic or medicinal properties.

Ito teaches a method of preventing "red rust", scale and slime from forming on the inner wall of a pipe (US Patent 5,055,189, column 3, lines 45-50) wherein the method comprises subjecting the water in the pipe to far IR and magnets. Thus, Ito teaches a method for having cleaner pipes as minerals and the like are more readily dissolved or remain in solution in the magnetically treated water and are therefore prevented from precipitating out of solution and onto the walls of the pipes. That is, the magnetization of the water improves the ability of the water to retain solutes such as minerals. Furthermore, one would expect that the tap water exiting the pipes as taught by Ito would be saturated with minerals as the object of the method is to clean the pipes, not to improve the quality of the water and related properties.

Patrasenko teaches a water purification system wherein incoming water is subjected to a magnetic field and is then cooled and aerated prior to flocculation and settling. The water is then filtered to remove iron oxides, nitrates, heavy metals, residual chlorine and organic compounds. Patrasenko states that "the prepared water

corresponds to quality standards for drinking water and has curative-prophylactic properties, due to higher activity of oxygen and other gases dissolved in water". Thus, Patrasenko teaches a water purification system that also involves aeration of water to add oxygen, and flocculation of the water and subsequent settling and filtering to remove contaminants. This water is suitable for drinking.

35 USC 103(a) Rejection is Contrary to MPEP 2141 (B) and (C)

The Examiner admitted that "Weed does not expressly teach to make water extract of oatstraw as herein claimed, or the addition of glycerin and lavender oil" but concluded that Puchalski teaches a polyol to enhance skin feel and Jakobson teaches the addition of lavender oil. Regarding "magnetically treated water", the Examiner has stated that "the employment of magnetically treated water for preparing therapeutical composition would have been obvious in view of Ito or Patrasenko [which] teach magnetic treatment provide cleaner water".

Applicant has argued repeatedly that Weed teaches adding dried oatstraw or pulverized baked oatstraw directly to bath water in which the body part(s) to be soaked are then immersed. Weed does not teach or suggest that other compounds may be added or that the oatstraw suspension may be mixed with other compounds. Weed also does not teach or suggest adding oatstraw to bath or shower products. Puchalski teaches a long list of optional components which may be added to the shampoo and bath gel products, none of which is oatstraw. Jakobson teaches a polyglycerol fatty acid ester mixture to be added to a bath which does not list oatstraw as a potential additive. It is further noted that the products themselves are incompatible – Puchalski teaches a body wash product whereas Weed and Jakobson effectively teach bath additives, one of which is water soluble (Weed) and one of which is not (Jakobson) and that as discussed above there would therefore be no incentive to combine these references. That is, Puchalski teaches a different type of product from Weed and Jakobson, and the products taught by Weed and Jakobson are themselves incompatible, one being water soluble (Weed) and the other being water insoluble (Jakobson). Furthermore, even if one of skill in the art did combine these references, taking Weed and combining Jakobson and Puchalski therewith one of skill in the art could have selected any one of the six other emollients suggested by Puchalski and any one of the sixteen other oils

listed by Jakobson and not produced applicant's invention. Thus, it is applicant's opinion that there is no incentive to combine Weed, Jakobson and Puchalski because each describes an incompatible product and Weed offers no teaching that oatstraw should be combined with other body cleansing agents. Furthermore, both Puchalski and Jakobson provide lengthy lists of optional additives and offer no teaching that specifically glycerine or lavender respectively are of particular usefulness or desirability.

Furthermore, neither Patrasenko or Ito teaches or suggests that an oatstraw extract prepared in magnetically treated water would have improved properties. Furthermore, even taking into account Patrasenko's comments regarding "curative-prophylactic properties", it is important to note that those relate to drinking water, not water which is applied to the skin or to other products. At best, Patrasenko may argue that using water prepared as described therein in preparation of an oatstraw extract was "worth a try" but that there was no guarantee that an extract prepared this way would have different properties on the skin compared to an extract prepared in untreated water, and certainly no suggestion that an oatstraw extract prepared in magnetically treated water would have improved spreading and "feel" characteristics with no sticky residue, compared to similar extracts prepared with deionized water or tap water.

As discussed previously, combining Weed with either Ito or Patrasenko teaches adding oatstraw to bath water which may be magnetically treated to improve water flow rates (Ito) or bath water which has been magnetically treated, oxygenated, flocculated, settled and filtered. Furthermore, the magnetized water taught by Ito would likely be saturated with minerals absorbed by the magnetically treated water while preventing scaling in the pipes and therefore on entering the bath tub, would likely not have a noticeable effect on the oatstraw suspension taught by Weed. It is also important to note that these references offer no suggestion to combine these teachings.

It is also noted that there must be incentive to combine references and the art must be considered as a whole. Specifically, no prior art has been cited which teaches or suggests that a filtered oatstraw extract would retain its properties compared to a suspension or that teaches or suggests that magnetically treated water would have improved rate and depth of absorption and "feel" properties when applied to the skin or

that an oatstraw extract in magnetically treated water would lack the associated stickiness so that it could be used as an additive or carrier. That is, no references have been cited which teach filtering an aqueous oatstraw extract to remove oatstraw particles or that use of magnetically treated water would produce an oatstraw extract that absorbed more rapidly and more deeply into the skin and that also lacked the residual stickiness found with filtered extracts prepared in tap water or deionized water. No references have been cited regarding the absorptive properties of magnetically treated water on skin. Thus, while the combination of the references cited by the examiner does not teach applicant's invention as discussed above, it is also clear that there is no incentive in the prior art to take the oatstraw soaking bath of Weed and use magnetically treated water instead of tap water. There is also no teaching or suggestion that so doing would eliminate the sticky residue left by the oatstraw bath taught by Weed or that the oatstraw particles of Weed could be removed from the soaking bath prior to use or that the oatstraw soaking bath could instead be bottled and used as a lotion, carrier or in combination with other products.

However, even if one of skill in the art were to combine the references, they teach preparing an oatstraw suspension in a tub of water, adding one of six emollients suggested by Puchalski, one of which may be glycerol, and adding any one of the sixteen oils listed by Jakobson, one of which may be lavender oil. If the user has followed the teachings of Ito to prevent scaling on incoming pipes, the bath water may be magnetically treated and contain minerals suspended therein. The user may also follow the teachings of Patrasenko and drink magnetically treated water while immersed in the oatstraw suspension. This is not applicant's invention. Applicant's invention is an oatstraw extract that is prepared by: magnetically treating water, heating the magnetically treated water, steeping oatstraw in the heated water and filtering the steeped oatstraw to remove oatstraw particles.

Applicant's invention differs from Weed and from the combination of the cited prior art in several ways. Specifically:

1) Weed teaches an oatstraw suspension bath, not a topical lotion or additive.

2) Weed does not teach or suggest filtering an oatstraw suspension to

prepare an oatstraw extract (and in fact teaches against filtering).

3) Weed does not teach or suggest the use of magnetized water. As discussed above, while Ito and Patrasenko do disclose benefits of magnetization to improving water flow (Ito) and as part of a water purification system (Patrasenko), they do not teach or suggest use of magnetized or magnetically treated water in combination with an oatstraw extract.

As will be appreciated, all three of these differences impact the invention and are connected. That is, once applicant discovered that the beneficial properties of the oatstraw are retained even in an oatstraw extract prepared by steeping the oatstraw in heated magnetically treated water and then removing the oatstraw residue, the opportunity to use the extract in other products was realized. The extract can be aliquoted for use as a topical lotion or can be added to other products. By removing the oatstraw residue, applicant has been able to produce an extract which can be applied to the skin or added to other products which would not be possible if the oatstraw extract was not filtered, as the oatstraw would leave an unpleasant residue or particles or clumps of oatstraw on the skin of the individual and the oatstraw would potentially interfere with other components within the other product.

35 USC 103(a) Rejection is Contrary to MPEP 2141.02 and MPEP 2141(C)

As discussed in a previously submitted declaration, in spring 2003, the inventor followed the teachings of Weed. Specifically, she added boiling water to dried oatstraw that had been chopped and then added that to a bathtub filled with warm water. What she found was that the chopped oatstraw stuck to her body and had to be physically removed or picked off. Furthermore, the free oatstraw clumps had to be scooped out of the bathtub during the draining process to prevent clogging of the drain. In addition, the water in the bathtub left a sticky residue on the body which could not be removed simply by wiping or drying with a towel and in fact required subsequent rinsing under a showerhead to remove the residue. That is, this residual stickiness in the bathwater was independent and separate from the oatstraw clumps. Similar results would be obtained using the teachings of Weed for any body part, for example, in a footbath. That is, the clumps of wet oatstraw adhere to the body, including the feet and must be physically removed and the water in the bath leaves a sticky residue on the

body parts exposed thereto, which is separate and independent from the oatstraw clumps. Her experiences following Weed led her to conclude that anyone following Weed would find the experience time-consuming, frustrating and in fact irritating to the skin due to the added effort necessary to remove the oatstraw clumps and residue, as discussed above. Given the difficulties associated with the removal of the oatstraw clumps and associated residue from her body as well as from the inner surfaces of the bathtub or waterbath, the inventor concluded that when Weed states "oats and all" she is saying to the reader "I know the oatstraw is messy, but it is necessary".

It is held that this declaration represents a comparison of the closest prior art with applicant's invention and that this declaration, which points out the limitations of Weed and also how one would interpret Weed as teaching away from filtering. It is held that this declaration has not been given proper weight by the examiner.

In the office action dated June 4, 2003, the examiner stated that Weed "teaches hot water extraction of oatstraw" and that "most of the active ingredients of oatstraw would have been extracted into water when 'extracted with boiling water'". The examiner has further stated that "using water extract only by filtering out the residues is an obvious alternative of keeping the residue in the water extract" and that "Weed does not teach against filtering. What Weed taught is a particularly situation, wherein the extract is made in situ".

Applicant informed the examiner that using the USPTO's definition of "extract", which requires that something be removed from the starting material, it is impossible to have an extract that is in its original form (i.e. in situ). Furthermore, Weed does not teach an extract because nothing is removed from the solution. It is also noted that in the most relevant example, Weed states that the oats are not to be removed. Thus, Weed does not teach an extract, Weed teaches a suspension. Weed teaches against filtering and does not teach or suggest that filtering would be beneficial or that one could expect filtering to produce a successful product. This is in contrast with applicant's invention, which is an oatstraw extract useful as a topical lotion or in other products.

It is further noted that the MPEP (2141) states that:

When applying 35 USC 103, the following tenets of patent law must be

adhered to:

(A) the claimed invention must be considered as a whole;

(B) the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination;

(C) the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and

(D) reasonable expectation of success is the standard with which obviousness is determined.

It is further noted that MPEP 2141.02 states that "a prior art reference must be considered in its entirety, i.e. as a whole, including portions that would lead away from the claimed invention."

Applicant maintains that the examiner's statement on page 5 of the Office Action dated June 4, 2003 that "Weed provides no teaching or suggestion that the particular method disclosed therein is the only method to employ oatstraw. One of ordinary skill in the art would understand that oatstraw contains beneficial ingredients and would have been motivated to employ oatstraw in method other than those expressly disclosed by Weed" is in conflict with MPEP 2141, particularly points (B) and (C). Specifically, the fact that (in the examiner's opinion) Weed does not state emphatically that this is the only method does not and cannot mean that Weed therefore discloses all other methods of employing oatstraw, including those methods that Weed does not describe or suggest. That is, Weed does not teach or suggest filtering oatstraw for use on the skin; rather, the document is focused on uses of whole oatstraw.

Furthermore, the examiner appears to be admitting that Weed does not teach or suggest filtering an aqueous extract of oatstraw and using same as a topical lotion as described by applicant but is then concluding that this would have been obvious. The examiner however provided no sections in Weed nor any additional references supporting this position.

It is held that the examiner is clearly considering Weed in hindsight in view of applicant's disclosure and is not considering Weed in its entirety which is contrary to MPEP 2141.

This point was discussed with the examiner in October 2003 in a

telephone interview. At that time, the examiner stated that the statement "Boil water and pour over oatstraw in a large tub. When cooled sufficiently, bathe. (Yes, with the oats and all.)" (Weed, page 205) was not a "strong statement" and implied that it was not a necessary step to include the oats in the tub.

This position is still not understood, as discussed herein. Weed states "yes, with the oats and all". There is nothing in that statement that implies that this is an optional step or that there is a choice involved. Furthermore, Weed does not teach or imply filtering to remove the oatstraw residue from an aqueous extract for skin application. Filtering would be inconsistent with the teachings of Weed as a whole which is focused on the benefits of whole oatstraw. Applicant simply cannot understand how this can be considered anything but a "strong statement" and that on this basis Weed teaches against filtering.

Furthermore, applicant's representative has carried out a search of the case law and appeal decisions for the term "strong statement" and has not been able to locate other usage of this term or a definition thereof. As such, it is unclear exactly what the examiner would consider to be a strong statement as there does not appear to be a definition for same. Furthermore, even if this is held to not be a "strong statement", the fact remains that Weed does not teach, describe or suggest the desirability of filtering the aqueous oatstraw extract for soaking body parts and that filtering and/or extracts go against the teachings of Weed when taken as a whole, as discussed above. It is also noted that on at least two occasions (when arranging the telephone interview of October 6, 2003 and during the interview of October 6, 2003), the undersigned requested that the examiner discuss this situation with a superior. Both times, this request was rebuffed.

In summary, the examiner has provided no references that teach or suggest filtering an aqueous oatstraw extract. The examiner instead is relying on the Weed reference but contrary to MPEP 2141, is not considering the reference in its entirety and is reading the reference in hindsight. Specifically, the examiner is claiming that Weed does not teach against filtering and therefore must teach filtering or in the contrary that filtering would be obvious to one of skill in the art. As discussed above, the statement "oats and all" teaches against filtering and there is no statement that implies

that filtering may be done. Furthermore, filtering would be inconsistent with the teachings of Weed as a whole which is focused on the benefits of whole oatstraw.

Thus Weed does not teach an extract: Weed teaches a suspension which must contain the oats. Weed does not teach a filtered oatstraw extract which is used as a topical lotion or as an additive: Weed teaches bath water containing oatstraw. Weed does not teach or suggest filtering the oatstraw solution but rather teaches that the oatstraw must be left in the suspension in order for benefits to be obtained.

The examiner is maintaining an objection which is not supported by the cited art. Furthermore, the examiner is applying hindsight and the teachings of applicant's disclosure to the Weed reference and as a consequence inferring disclosure that is simply not present in Weed. It is further noted that the examiner has maintained that filtering an aqueous extract of oatstraw is obvious in view of prior art dealing with extracts of herbs and such but has not provided any references which specifically teach a filtered aqueous extract of oatstraw.

35 USC 103(a) Rejection is Contrary to MPEP 716.02 (a) and (b)

The invention is further distinguished from the prior art by the preparation of the oatstraw extract in magnetically treated or magnetized water. The combination of oatstraw extract in magnetically treated water has surprising properties compared to extracts prepared in tap water or deionized water.

As discussed in the submitted Declarations and responses, it is believed that the magnetic treatment of water increases the ability of the water to retain solutes, such as minerals or in applicant's case, compounds secreted from the oatstraw during the steeping process. Applicant notes that when water passes through a magnetic field, the hydrogen ions and dissolved minerals in the water become charged. This charge causes a temporary separation of these minerals and molecular water clusters resulting in water with increased clarity and softness, and reduced surface tension. In applicant's invention, this enhances the physical characteristics of the extract, such as conductivity, viscosity, softness and in turn facilitating ease of application, rate/depth of absorption and moisturization quality without leaving a film. A first benefit of this combination of oatstraw extract in magnetically treated water is that more of the beneficial compounds secreted by the oatstraw are retained in solution in the magnetically treated water. A

second surprising benefit is that the oatstraw extract in magnetically treated water has greater rate and depth of absorption compared to comparable extracts prepared in either tap water or deionized water. A third surprising benefit is that the oatstraw extract in magnetically treated water lacks the residual stickiness found in the extracts prepared with either tap water or deionized water, as discussed in the Declaration and in the previously filed affidavits. It was this discovery that enabled the inventor to realize that the extract could be added to other products and resulted in such products being produced.

It is respectfully believed that that the difficulties encountered regarding the use of magnetically treated water or magnetized water as a limitation are based in part on the failure of the examiner to consider the properties of magnetized water or magnetically treated water fairly and objectively.

In the office action dated November 26, 2002, the Examiner stated that he could "find no support in scientific literature that 'magnetized' water differs from 'water' in any way". Applicant responded by providing copies of articles on magnetization, including "Magnetic treatment of water: possible mechanisms and conditions for applications", by V. Kochmarsky, Magnetic and Electrical Separation **7**: 77-107, 1996 and Johnson et al., 1998, Journal of Clinical Periodontology **25**: 316-321, showing that the effects of magnetization on water were documented.

Despite this, in the office action dated June 4, 2003, the examiner stated that "the examiner has not been convinced that "magnetized water" and water would be any different for lacking of scientific evidence. The examiner fails to understand how the molecules of water, or their arrangement would be affected by magnet". An explanation of the magnetization process and its role in the instant invention similar to that above was provided in the response.

In a later office action, the examiner stated that "features upon which applicant relies (i.e., minerals in water) are not recited in the rejected claim(s)". This statement was not understood, because the mineral content of the water was not being claimed but rather that it was the ability of the magnetically treated water to retain more solutes that was important. Specifically, it is believed that magnetically treating water increases the ability of the water to retain solutes, whether these solutes are minerals in

a pipe as taught by Ito or components of an aqueous oatstraw extract as taught by the inventor. As such, the mineral content of the water is not important as the magnetization of water which will increase the ability of the water to retain solutes compared to untreated water regardless of the mineral content of the water. It is also unclear exactly how the examiner came to the conclusion that the mineral content of the water was a feature upon which applicant was relying.

The examiner also rejected the arguments on the basis of the obviousness of using magnetically treated water as "cleaner" water. As noted above, it is not "cleaner" water per se that results in applicant's invention but the magnetic treatment which increases the ability of the water to retain components secreted by the oatstraw during steeping and also results in an extract having improved rate and depth of absorption and spreading properties as discussed previously.

Furthermore, in the office action dated November 17, 2004, the examiner stated that applicant had failed to argue against the combination of the references and that "the citing of Ito and Patrasenko is merely to show that magnetic treatment of water is well-known in the art and would have been obvious to one of skill in the art to use such process for a cleaner water". As discussed in the subsequent response, this objection was not understood because the examiner appeared to be objecting to the fact that applicant did not analyze references which were not cited. **It is also important to note that the examiner's opinion on the effect of magnetization on water had progressed from making no difference to being obvious.**

The idea that the benefits of magnetically treating water was controversial at best was also the initial position of Mr. Rick Green, whose affidavit was previously provided. As discussed in the inventor's affidavit, she expressed concern regarding the use of deionized water; however, she was told by the contractor (Mr. Rick Green) to expect "the same product results with either the deionized water or the magnetized water". As discussed in detail in paragraph 6 of the inventor's affidavit, that was not the case. Specifically, the samples prepared with deionized water were difficult to spread, slow to penetrate the skin and left a residual "stickiness" when applied to the skin. This is in contrast with the samples prepared with the magnetically treated water which was quick to absorb and left no residue.

It is again noted that deionized water is considered to be cleaner than tap water and that it was not the "cleanness" of the water that affected the properties of the extract but the magnetic treatment of the water that produced the improved extract as discussed in the previously provided affidavits.

It is noted that MPEP 716.02 (b) states that "evidence of unexpected properties may be in the form of a direct or indirect comparison of the claimed invention with the closest prior art which is commensurate in scope with the claims".

The examiner stated that the affidavits of the inventor and Rick Green submitted previously were not relevant because they were "directed at a distinction between deionized water and 'magnetized' water".

It is held that these affidavits were not given proper consideration by the examiner. It is held that in accordance with MPEP 716.02 (b), the affidavits provide evidence of unexpected properties and that they represent at least an indirect comparison between applicant's invention and the cited art but more importantly are commensurate in scope with the claims. That is, these affidavits show the effect of substitution of magnetically treated water for deionized water in applicant's oatstraw extract.

35 USC 103(a) Rejection Contrary to MPEP 716.01(c)

It is also noted that the MPEP 716.01 (C) states that "'some weight ought to be given to a persuasively supported statement of one skilled in the art on what was not obvious to him'". In this instance, the expert (Mr. Green) has stated that he believed that deionized water and magnetically treated water would produce an extract with the same properties and that he was wrong. It is further noted that in this instance, the expert has no interest in the outcome of this case.

35 USC 103(a) Rejection is contrary to MPEP 2144

It is noted that the examiner also stated numerous times that for examination purposes magnetized water was considered to be equivalent with tap water. Applicant noted that regular tap water is not used in cosmetic or pharmaceutical preparations and that deionized water is used, meaning that in this instance, the use of deionized water in the process described in the affidavits is proper, considering the extract is used as a topical lotion or additive.

It is also noted that on one hand the examiner is taking the position that magnetically treated water is equivalent to tap water for the examiner's purposes but on the other hand that tap water is not equivalent to deionized water. It is further noted that as discussed above the literature contains support for differences between magnetized water and other types of water, for example, deionized water. It is of note that differences in conductivity and pH were noticed between deionized and magnetically treated water as discussed in Mr. Green's affidavit. The affidavits also describe the differences observed when applicant's invention was prepared with deionized water instead of magnetically treated water.

Applicant notes that the MPEP 2144 states that "the examiner must apply the law consistently to each application after considering the relevant facts. If the facts in a prior legal decision are sufficiently similar to those in an application under examination, the examiner may use the rationale used by the court." In this case, the "prior legal decision" is the precedent at the USPTO regarding the patentability of magnetically treated fluids.

As discussed above, the claims state that the water is magnetically treated water. Applicant notes that several references describing the benefits of magnetically treating water have previously been provided and also notes that there is precedent at the USPTO regarding the patentability of magnetically treated fluids, such as US Patent 5,905,265 as well as devices for magnetically treating fluids, such as US Patent 5,500,121. Other patents relating to devices and methods for magnetically treating water or other fluids as well as patents which describe the utility of magnetically treated water include US Patent 6,250,118; US Patent 5,584,994; US Patent 6,171,490; US Patent 5,009,791; US Patent 4,946,590; US Patent 5,296,141; US Patent 5,500,121; US Patent 5,837,143; US Patent 5,866,010; US Patent 4,146,479; US Patent 4,299,700 and US Patent 4,422,933.

Thus, there is precedent at the Patent Office for allowing claims including magnetically treated fluids as limitations within the claims and also for devices for magnetically treating fluids such as water, clearly indicating that the Patent Office has previously recognized that magnetically treated water has unique and different properties. On this basis, it is believed that the claims including magnetically treated

water should be approved. Furthermore, as discussed in the previously submitted declarations, the oatstraw extract prepared with magnetically treated water had improved properties compared to extracts prepared with deionized water, specifically, rate and depth of absorption and absence of residue to name a few. No references describing the desirability of preparing an aqueous extract of oatstraw or of combining same with magnetically treated water have been cited.

The Invention as Claimed

GROUP 1 – Claim 1

As discussed above, there is no incentive to combine the cited references and even if combined, they do not teach applicant's invention. Specifically, no reference has been cited which teaches a filtered oatstraw extract prepared in magnetically treated water.

Group 2 – Claim 8

This claim is directed to one use of the lotion, for treatment of painful, inflamed or swollen areas. It is of note that the lotion is applied topically and does not require soaking in an oatstraw suspension as taught by Weed.

Group 3 – Claim 17

This claim is directed to the use of the oatstraw extract as an additive which can be added to other products. As discussed above, filtering to remove the oatstraw residue makes it possible to add the extract to other products which is not taught or suggested by Weed or the cited prior art.

Group 4 – Claim 18

This claim is directed to a hair or body product containing the oatstraw extract. As discussed above, filtering to remove the oatstraw residue makes it possible to add the extract to other products which is not taught or suggested by Weed or the

cited prior art.

Group 5 – Claim 20

This claim is similar in scope to claim 1 but is directed to the method of preparing the oatstraw extract. The same comments as re: group 1 apply.

Group 6 – Claim 25

This claim is directed to a method of preparing an oatstraw extract for treating pain, swelling or inflammation. The same comments as re: group 2 apply.

Group 7 – Claim 26

The same comments as re: group 3 apply.

In summary, it is believed that the rejection under 35 USC 103 should be reversed for the following reasons:

1) There is no incentive to combine the cited references, as discussed above. Specifically, there is no indication in the combination of references of the desirability of preparing an aqueous oatstraw extract in magnetically treated water or the improved absorptive properties thereof.

2) As discussed above, even if combined, the cited art does not lead to applicant's invention.

3) The examiner's analysis of Weed is contrary to MPEP 2141 (B) and (C) in that the examiner is not considering the reference in its entirety and is also reading the reference in hindsight.

4) No references have been cited which teach or suggest filtering of an aqueous oatstraw suspension.

5) The submitted affidavits regarding the surprising properties of an oatstraw extract in magnetically treated water have not been given sufficient weight, contrary to MPEP 716.02 (b) and MPEP 716.01 (c).

6) Contrary to MPEP 2144, the use of magnetically treated water as a feature of the claims has not been properly considered.

8. Claims Appendix

1. (previously presented) A topical lotion for relieving pain, swelling or inflammation comprising: glycerine; lavender oil; and the active ingredient consisting of oatstraw extract, said oatstraw extract prepared by magnetically treating a quantity of water; heating the magnetically treated water; steeping oatstraw in the magnetically treated heated water and filtering the steeped oatstraw to remove oatstraw particles.

5. (previously presented) The topical lotion according to claim 1 wherein the glycerine is vegetable glycerine.

6. (previously presented) The topical lotion according to claim 1 wherein the topical lotion consists essentially of:

at least 50% oatstraw extract;

at least 25% glycerine; and

0.1-0.2% lavender oil,

the sum of these three components being 100%.

7. (previously presented) The topical lotion according to claim 1 wherein the topical lotion consists essentially of:

0.1% lavender oil;

25% vegetable glycerine; and

q.s. to 100% filtered oatstraw extract in magnetically treated water.

8. (previously presented) A method of treating pain, swelling, itching or inflammation comprising:

providing a topical lotion the lotion consisting essentially of:

at least 50% oatstraw extract, said oatstraw extract prepared by magnetically treating a quantity of water; heating the magnetically treated water; steeping oatstraw in the magnetically treated heated water and filtering the steeped

oatstraw to remove oatstraw particles;

at least 25% glycerine; and

0.1-0.2% lavender oil,

the sum of these three components being 100%; and

applying the lotion topically to inflamed, painful or swollen areas.

9. (original) The method according to claim 8 wherein the pain, swelling, itching or inflammation is caused by a condition selected from one of the following: psoriasis; skin poisoning from plants, shingles; measles; chicken pox; boils; sun damage; burns; sunburns; acne; eczema; rosacea; dermatitis; insect bites; herniated discs; back and/or leg spasms; sore or damaged muscles, ligaments and tendons; bruising; headaches; and arthritis.

17. (previously presented) An additive comprising:

a mixture consisting essentially of:

at least 50% oatstraw extract, said oatstraw extract prepared by magnetically treating a quantity of water; heating the magnetically treated water; steeping oatstraw in the magnetically treated heated water and filtering the steeped oatstraw to remove oatstraw particles;

at least 25% glycerine; and

0.1-0.2% lavender oil,

the sum of these three components being 100%; and

a suitable carrier.

18. (previously presented) A hair or body product comprising:

a mixture consisting essentially of:

at least 50% oatstraw extract, said oatstraw extract prepared by magnetically treating a quantity of water; heating the magnetically treated water; steeping oatstraw in the magnetically treated heated water and filtering the steeped oatstraw to remove oatstraw particles;

at least 25% glycerine; and

0.1-0.2% lavender oil,
the sum of these three components being 100%; and
a suitable carrier.

19. (original) The body or hair product according to claim 18 selected from the group consisting of: body washes; shaving creams; shaving gels; shaving lotions; shampoos; conditioners; body lotions; moisturizing lotions; facial and wrinkle lotions; hand lotions; body creams; hand creams; facial creams; after-shave lotions; skin cleansing preparations; make-up removers; personal deodorants; suntan oil preparations; sunscreen preparations; sun block preparations; lip balms; aromatherapy products; massage gels; foot lotions; facial masques; pimple/acne preparations; facial and body firmers; pore size reducing preparations; styling lotions; and styling sprays.

20. (previously presented) A process for preparing an oatstraw extract comprising:
providing a quantity of oatstraw;
magnetically treating a quantity of water;
heating the magnetically treated water;
placing the oatstraw in the magnetically treated heated water;
steeping the oatstraw in the magnetically treated heated water, thereby producing an oatstraw mixture; and
filtering the oatstraw mixture, thereby producing an oatstraw extract.

22. (previously presented) The process according to claim 20 wherein the topical lotion consists essentially of:
at least 50% oatstraw extract;
at least 25% glycerine; and
0.1-0.2% lavender oil,
the sum of these three components being 100%.

24. (original) The method according to claim 8 wherein the pain, swelling,

itching or inflammation is caused by a condition selected from one of the following: leprosy; cold sores; colds and flu; sinus congestion; menstrual bloating; menstrual cramps; foot pain; parasitic infections; varicose veins; fibromyalgia; multiple sclerosis; cancer treatments; internal organ injuries; and brain and nerve surgery.

25. (previously presented) A topical lotion for relieving pain, swelling or inflammation comprising:

the active ingredient consisting of oatstraw extract, said oatstraw extract prepared by magnetically treating a quantity of water; heating the magnetically treated water; steeping oatstraw in the magnetically treated heated water and filtering the steeped oatstraw to remove oatstraw particles,

wherein the lotion is applied topically to the skin of an individual in need thereof.

26. (previously presented) An additive comprising:

the active ingredient consisting of oatstraw extract, said oatstraw extract prepared by magnetically treating a quantity of water; heating the magnetically treated water; steeping oatstraw in the magnetically treated heated water and filtering the steeped oatstraw to remove oatstraw particles,

wherein the additive is added to another product.

30. (previously presented) The additive according to claim 26 wherein the product is a cosmetic or pharmaceutical product.

9. Evidence Appendix

The following is a listing of the evidence referred to herein.

U.S. Patent 4,690,818 of Puchalski, Jr. et al. issued September 1, 1987 and was cited in the Office Action mailed February 12, 2002.

U.S. Patent 5,055,186 of Ito issued October 8, 1991 and was cited in the Office Action mailed May 5, 2004.

U.S. Patent 5,397,497 of Jakobson et al. issued March 14, 1995 and was cited in the Office Action mailed February 12, 2002.

U.S. Patent 5,905,265 of Gubernick et al. issued May 18, 1999 and was discussed in the Office Action mailed November 26, 2002.

Susun W. Weed, "Wise Woman, Herbal healing wise", 1989, ISBN: 0-9614620-2-7, pp 192-205 was cited in the Office Action mailed February 12, 2002.

Patrasenko et al. RU 2085296 1997, abstract, DWPI AN 1998-143751 was cited in the Office Action mailed May 5, 2004.

The affidavit of the inventor, Lorraine Mignault, under 37 CFR 1.132 executed on January 11, 2005 was discussed in the Advisory Action mailed March 9, 2005.

The declaration of the inventor, Lorraine Mignault, under 37 CFR 1.132 executed on October 8, 2002 was discussed in the Office Action mailed November 26, 2002.

The declaration of Richard Green under 37 CFR 1.132 executed on October 1, 2002 was discussed in the Office Action mailed November 26, 2002.

"Magnetic Treatment of water: possible mechanisms and conditions for applications", by V. Kochmarsky, *Magnetic and Electrical Separation* **7**: 77-107, 1996 was submitted with and discussed in the response dated February 25, 2003.

Johnson et al., 1998, Jouranal of Clinical Periodontology **25**: 316-321 was submitted with and discussed in the response dated February 25, 2003.

The list of issued US Patents relating to magnetically treated fluids (US Patent 6,250,118; US Patent 5,584,994; US Patent 6,171,490; US Patent 5,009,791; US Patent 4,946,590; US Patent 5,296,141; US Patent 5,500,121; US Patent 5,837,143; US Patent 5,866,010; US Patent 4,146,479; US Patent 4,299,700 and US Patent 4,422,933) was provided in the response dated February 11, 2004.

10. Related Proceedings Appendix

There are no related proceedings.

It is requested therefore that the rejection under 35 USC 103 be reversed.

We hereby authorize you to charge the fee for filing this brief in support of an appeal $250 to our Deposit Account No: 01-0310. In the event that any additional fees are required, you are hereby authorized to charge or credit any additional fees to our deposit account 01-0310.

Respectfully submitted

LORRAINE MIGNAULT

PER: _____
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Registration No: 45,333

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The effectiveness of a magnetized water oral irrigator (Hydro Floss®) on plaque, calculus and gingival health

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Johnson KE, Sanders JJ, Gellin RG, Palesch YY: The effectiveness of a magnetized water oral irrigator (Hydro Floss®) on plaque, calculus and gingival health. J Clin Periodontol 1998; 25: 316–321. © Munksgaard, 1998.

Abstract. The purpose of this study was to evaluate the effects of a magnetized water oral irrigator on plaque, calculus and gingival health. 29 patients completed this double-blind crossover study. Each patient was brought to baseline via an oral prophylaxis with a plaque index ≤1 and a gingival index ≤1. Subjects used the irrigator for a period of 3 months with the magnet and 3 months without the magnet. After each 3 month interval, data were collected using the plaque index, gingival index, and accretions index. The repeated measures analysis on plaque, gingival and calculus indices yielded a statistically-significant period effect for PII (p=0.0343), GI (p=0.0091), and approached significance for calculus (p=0.0593). This meant that the effect of irrigation resulted in a decrease of all indices over time. Therefore, the treatment effect on each index was evaluated using only the measurements obtained at the end of the first period (i.e., assuming a parallel design). Irrigation with magnetized water resulted in 64% less calculus compared to the control group. The reduction was statistically significant (p≤0.02). The reduction by 27% in gingival index was not statistically significant. The reduction in plaque was minimal (2.2%). A strong positive correlation between the plaque index and the Watt accretion index was observed. The magnetized water oral irrigator could be a useful adjunct in the prevention of calculus accumulation in periodontal patients, but appears to have minimal effect on plaque reduction. The results indicated a clinical improvement in the gingival index, but this was not a statistically significant finding.

Key words: irrigation; plaque control; magnetized water; calculus

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Plaque is the primary etiologic agent in chronic inflammatory periodontal disease, with calculus a contributing factor. Teeth with calculus have been shown to have a significantly higher rate of loss of attachment than those that remain calculus free (Anerud et al. 1991). Toothbrushing is universally accepted as a standard method to control plaque and calculus formation (Bass 1954). In recent years, oral hygiene standards have improved (Kornman & Löe 1993). However, a need still exists for techniques to significantly decrease plaque and calculus formation.

Studies have shown that oral irrigators can be useful adjuncts in an oral physiotherapy program (Lang & Räber 1981, Lang & Ramscier-Grossmann 1981, Boyd et al. 1985). However, opportunities clearly exist to improve their effectiveness (Derdivanis et al. 1978, Watt et al. 1993). A double-blind study by Watt et al. (1993) showed that magnetically-treated water flowing through an oral irrigator significantly decreased plaque and calculus (combined) by 45%.

Under normal physiologic conditions, the tooth and bacterial surfaces carry a net negative charge. The mediation of attachment for plaque and calculus (Mandel 1963) involves the interaction of bacteria which are negatively charged (Rölla 1977), and amphipatic substances which can change the charge of the tooth resulting in bacterial attachment (Krasse 1977). These interactions, which are normal occurrences, allow for the mineralization of plaque on tooth surfaces. In theory, a magnetized water oral irrigator inhibits the bonding process by which bacteria colonize and by which plaque attaches to teeth. This inhibition is based on the principle of magnetohydrodynamics. Magnetohydrodynamics prevents naturally-occurring mineral deposits in

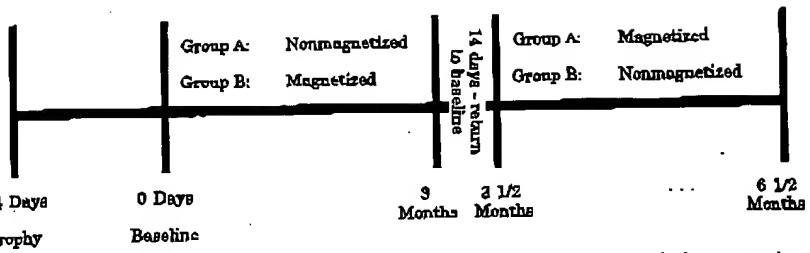

Fig. 1. Experimental design. Beginning at baseline, gingival index, plaque index, accretions index and modified accretions index were recorded at 3 months and 6.5 months. At 3 months, a prophylaxis was performed, followed by a 14-day "wash out" period.

fluids from changing from a liquid to a solid state (Grutsch & McClintock 1984, Hibben 1973). This occurs by interruption of the normal process of ionization (electrovalent bonding of ions), and therefore prevents the formation of deposits which would otherwise adhere to a host surface. By applying this principle to an oral irrigator, the bonding process by which bacteria colonizes, and by which plaque and calculus adheres and accumulates on teeth is inhibited.

The purpose of this study was to evaluate the effects of a magnetized water oral irrigator (*Hydro Floss®) on gingival inflammation, plaque and calculus formation.

Material and Methods

32 patients who presented with supragingival calculus volunteered for this study at the Medical University of South Carolina. Patients met the following criteria to participate.

(1) No systemic conditions contraindicating dental treatment.

(2) No systemic antibiotics during the previous 6 months.

(3) Visible supragingival plaque and calculus present on the buccal and/or lingual of the lower 6 anterior teeth (Kornman & Löe 1993).

(4) Proven calculus producers by documented history.

All patients voluntarily signed an informed consent document approved by the Institutional Review Board for Human Research of the Medical University of South Carolina.

All patients were brought to baseline through supragingival and subgingival scaling and rubber cup polishing, by the principal investigator (KEJ). They began the study (Fig. 1) 2 weeks after the subgingival scaling of the lower anterior teeth, with a Löe & Silness (1963) gingival index of ≤1, and a Turesky plaque index (1970) of ≤1. The patient's gingival condition was scored with the Löe and Silness (1963) gingival index on the facial, lingual, mesial and distal aspects of the mandibular anterior teeth. Anatomical line angles delineated the 4 areas. The areas between the mesio-facial and disto-facial line angles, and the mesio-lingual to disto-lingual line angles were considered the facial and lingual surfaces, respectively. The areas between the mesio-facial and mesio-lingual line angles and the disto-facial and disto-lingual line angles were considered the mesial and distal surfaces, respectively.

Plaque was disclosed with red disclosing solution (Red-Cote#, FDC #3) and the Turesky-Gilmore-Glickman Modification (1970) of the Quigley-Hein plaque index was used. A score of 0 to 5 was assigned to each facial and lingual surface of the lower anterior teeth. This tooth system was used to replicate the system used in the original report by Watt et al. (1993) on the effects of a magnetized water oral irrigator. Though the data was collected blindly by the principal investigator (KEJ), all investigators were initially calibrated to improve reproducibility and to reduce inter and intra examiner differences.

Irrigation units (HydroFloss®) were supplied and coded by the manufacturer. Sixteen units had their magnetic devices removed by the manufacturer during the first phase of the study. In an effort to standardize the water flow of the irrigators, all the low and high settings were disabled by the manufacturer, so that all of the participants were using the medium flow setting. To ensure a double blind clinical trial, neither the examiner nor the patient knew which units had the magnetic devices in them. The units were given to the patients with the following instructions.

(1) Irrigate 2× a day per the manufacturer's instructions: "Hold the jet tip at a right angle, directing the flow of water to the center of the tooth at the gum line for approximately five seconds on the front side of each tooth and 5 s on the back side of each tooth. As you go from tooth to tooth, direct the flow of the water between your teeth long enough to remove debris. For best results, this procedure should be followed 2× daily, once each morning and once each evening."

(2) Use the unit specifically on the lower 6 anterior teeth.

(3) Oral hygiene procedures of the lower 6 anterior teeth will be restricted to manual tooth brushing and the oral irrigator.

No instructions were given on brushing technique or length of brushing. However, the subjects were instructed not to use floss, interdental brushes or mouthrinses in the study areas during the study periods.

After 3 months of oral irrigator use, the indices were recorded again. The accretions index (Watt et al. 1993) evaluated: (1) the height of the accretions from the gingival margin up to 3 mm to the coronal portion of the tooth; (2) the thickness of the accretions on the tooth surface. A periodontal probe was used to measure the thickness of the accretions following the design recommendations of Detsch (1980) to obtain measurements accurate to 0.1 mm. The design of this probe utilizes a 0.021 inch orthodontic wire attached to a Boley Gauge†. The orthodontic wire is housed within a 16 gauge stainless steel catheter with a 1.2 mm internal diameter.

The Watt accretions index was utilized (Fig. 2):

(1) Measurements were taken on the 6 surfaces of each anterior tooth (DF, F, MF, ML, L, and DL). The surfaces were delineated by line angles.

(2) Each of the 6 tooth surfaces were further divided into 3 sections via an apical-incisal delineation. Therefore 18 sections (9 on the facial and 9 on the lingual) were assessed for thickness of accretions. Fig. 2 is the chart for recording one surface. All 18 sections

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John O. Butler Company, Chicago, Illinois 60630, USA.

† Hu-Friedy, Chicago, Ill. 60618, USA.

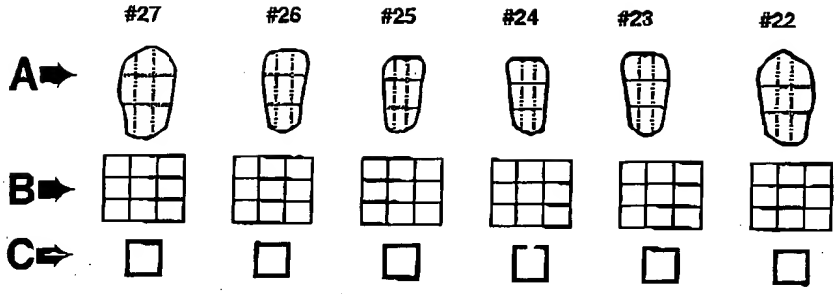

Fig. 2. Accretions charting record. *a.* Each surface (facial and lingual) was divided into 9 sections. *b.* The thickness of accretions in each section was measured using the following scoring: "0"=0.0 mm, "1"=>0.0 to <0.5 mm, "2"=≤0.5 to <1.0 mm, "3"=≥1.0 mm. *c.* The sum of all the scores in part B.

were summed, and thus no data is reported by section.

(3) For each of the 18 sections, a thickness measurement was recorded using the following scoring: "0" (no visible deposit)=0.0 mm, "1"=>0.0 to <0.5 mm, "2"=≥0.5 to <1.0 mm, and "3"=≥1.0 mm.

After this index (measuring plaque and calculus) was scored, a rubber cup polishing was performed to score calculus only (referred to as the modified Watt accretion index). Both the Watt accretions index and the modified Watt accretion index were scored at the 3 month and 6.5 months evaluations.

Gingival, plaque and accretions indices were assessed by the principal investigator (KEJ). After the 1st 3 months of use and assessment completions, a crossover was initiated to have the patients serve as their own controls. The units were returned to the manufacturer to remove the magnetic device from those units that had them in place, and to replace the magnetic devices in those that had them removed. All patients were again brought back to base-line. The units now with the new modifications were re-issued to the patients, with instructions on their use for another three months. Patients were re-examined after the 2nd 3-month period, and the same clinical data collected and assessed by the principal investigator (Fig. 1).

If a unit malfunctioned, the manufacturer was given the code of the unit and the investigator was told which of the remaining units could be issued to the patient in order to ensure that the same type of unit was being used for that clinical period.

Statistical analysis

For each participant, his/her gingival and plaque indices were derived by averaging the respective scores form the surfaces of the 6 lower anterior teeth (#22 through #27). The plaque index used in the analysis was calculated by averaging the scores from the facial and lingual surfaces of the 6 teeth. The gingival index was derived by taking the average of the scores from distal facial, facial, mesial facial, mesial lingual, and distal lingual surfaces from the 6 teeth. The accretion index was based on the nine scores from the subdivided facial surface of the 6 teeth.

The resulting indices were approximately normally distributed. Consequently, standard univariate parametric tests, such as the two-sample *t*-test to compare the mean indices between the magnetized and non-magnetized groups, and the paired *t*-tests to evaluate the differences between facial and lingual or proximal and non-proximal surfaces, were utilized. Analysis of covariance method was used to compare the differences in the mean indices between magnetized and non-magnetized groups adjusting for age and sex. The Pearson correlation coefficients were calculated to evaluate the degree of association between the plaque and accretion indices.

Results

Of the 32 patients who enrolled in this study, 29 completed both periods of the double blind, two-period crossover clinical trial. One patient voluntarily left after the first visit, one moved to another country, and one was hospitalized for an unrelated ailment. During the study, 4 units had to be reissued by the manufacturer. Two were accidentally dropped by patients and two lost/delayed in the mail during the crossover periods.

Since all the patients' teeth were cleaned prior to each of the 2 periods such that the average scores of their plaque, gingival and calculus indices were zero, no clinical carryover effect is assumed. The repeated measures analysis on plaque, gingival and calculus indices yielded a statistically significant period effect for PII (p=0.0343), GI (p=0.0091), and approached significance for calculus (p=0.0593). This meant that an overall reduction in the indices occurring over the 2 trial periods was not necessarily due to the treatment (magnetized) but possibly to the fact that water oral irrigation was used, or a placebo effect due to participation in a study itself. Therefore, the treatment effect on each of the indices (unadjusted and adjusted for age and sex) was evaluated using only the measures taken at examination 3 at the end of the first period, hence assuming a parallel design. The results of the analyses are given in Table 1.

The treatment with the magnetized water yielded a significantly lower calculus index (64%) during the first period, even after adjusting for age and sex. Gingival inflammation was reduced by 27.5%, which was not statistically significant. There was no significant reduction in plaque index (2.2%). Post-

Table 1. Indices at 3 months

Index	Group[a]	Mean	SE	p (unadj.)	p (adj.)[b]
Plaque (Turesky)	A	1.80	0.22	0.8865	0.9128
	B	1.76	0.22		
Gingival (Löe & Silness)	A	0.80	0.09	0.1130	0.0655
	B	0.58	0.10		
Calculus (modified Watt's)	A	0.42	0.09	0.0087	0.0172
	B	0.15	0.03		

[a] Group A (n=16) used non-magnetized water from baseline to 3 months and group B (n=13) used magnetized water.
[b] Adjusting for age and sex.

Table 2. The Pearson correlation coefficient between the Turesky plaque index and the Watt accretion (plaque and calculus) index (n=29)

Surface	Period 1	Period 2
facial	*0.66	*0.85
lingual	*0.69	*0.69

* $p<0.0001$.

analysis power calculations show that the t-tests which yielded the non-significant results had power of 95% to detect a 45% difference in the plaque index and a power of 97% to detect a 45% difference in the gingival index, between the treated and placebo groups.

The Pearson correlation coefficients between the Turesky plaque index and Watt accretion (plaque & calculus) Index are listed in Table 2 by surface (facial and lingual) and by treatment period. These coefficients were significantly different from zero ($p<0.0001$). Therefore, the Watt accretion index showed a strong positive association with the Turesky's plaque index.

Table 3 provides the results from the analyses of the Turesky plaque index comparing the facial and lingual surfaces. Regardless of treatment or period, lingual surfaces had statistically significantly higher plaque indices than facial surfaces. Difference in plaque index was affected more by period, rather than treatment.

Table 4 compares the results for gingival index between interproximal and nonproximal surfaces. The interproximal surfaces had higher gingival indices than the non-proximal surfaces. The difference in gingival index between interproximal and nonproximal surfaces was statistically significant regardless of treatment or period.

Discussion

The use of a magnetized water oral irrigator showed 64% less calculus formation in the test group than the control group, which was a statistically significant finding. Although the gingival index was 27% lower with the group using the magnetized water, this was not statistically significant. There was not a statistically significant difference for plaque index (PII 2.2%). Our findings are consistent with studies that examined supragingival irrigation. Numerous authors have found that gingival inflammation either persisted or developed with supragingival irrigation (Lang & Räber 1981, Lang & Ramseier-Grossmann 1981, Hugoson 1978, Lobene et al. 1972, Southard et al. 1987). Similarly, no difference in plaque accumulation between the control and treated groups with supragingival irrigation was noted by Derdivanis et al. (1978). Based on the theory of hydromagnetics it is not a surprising finding that the irrigator had minimal effect on plaque accumulation, but a statistically significant effect on calculus formation. Calculus is mineralized plaque that forms by the bathing of the plaque in a supersaturated solution of Ca^{++} and PO_4-saliva. The magnetized water irrigator simply prevents or inhibits the process of this mineralization from occurring. Therefore, it appears that plaque continues to be produced at its normal rate in the individual patient, but the mineralization process is interrupted. This principle of hydromagnetics, first described by Faraday in 1832, has been used successfully in industry for years to reduce lime and scale deposits adherence to pipes (Grutsch & McClintock 1984).

Criticisms of the study by Watt et al. (1993) included the fact that the investigators did not: (1) attempt to standardize the water flow through the irrigator, (2) demonstrate that their experimental and control groups were matched in deposit forming capabilities, (3) separate plaque from calculus in their assessments. Furthermore, an assessment of clinical effectiveness was not a part of their experimental design, nor were the indices used standard in the literature for obtaining these measurements. The original design of our study attempted to address these concerns by having patients serve as their own controls via a crossover design, collecting data with traditional periodontal indices, and incorporating the Watt accretions index. The Turesky-Gilmore-Glickman modification (1970) of the Quigley-Hein plaque index used in this study has been used in many clinical trials documented in the literature, and was selected due to its capability of measuring plaque over the entire tooth surface. The Watt accretion index in spite of the criticism of it not being a traditional periodontal index, showed a strong positive association with the Turesky plaque index. This was probably due to the fact that both indices assess plaque starting at the gingival margin, progressing coronally on the tooth surface.

For each participant, gingival, plaque and accretion indices for the entire mouth were determined by averaging the respective scores from the surfaces measured on the 6 teeth. The plaque index analyzed was calculated from taking the average scores from the facial and lingual surfaces of the lower anterior teeth (#22–27) of each participant. Similarly, the gingival index for each participant was derived from averaging the scores from distal facial (DF), facial (F), mesial facial (MF), mesial lingual (ML), lingual (L), and distal lingual (DL) surfaces of the lower anterior teeth (#22–27). The accretion index was based on 18 scores from the subdivided facial and lingual

Table 3. Turesky plaque index: mean difference between facial and lingual surfaces

Group	Period	Mean	SE	p*
A	1 (non-magnetized)	−0.33	0.32	0.3128
A	2 (magnetized)	−0.52	0.16	0.0057
B	1 (magnetized)	−0.05	0.29	0.8615
B	2 (non-magnetized)	−0.52	0.22	0.0331

* p-value for the paired t-test to test the significance of the difference between facial and lingual plaque index.

Table 4. Gingival index (GI): mean difference between non-proximal and interproximal surfaces

Group	Period	Mean	SE	p*
A	1 (non-magnetized)	−0.09	0.04	0.0390**
A	2 (magnetized)	−0.07	0.03	0.0560
B	1 (magnetized)	−0.11	0.05	0.0398**
B	2 (non-magnetized)	−0.09	0.03	0.0124**

* p-value for the paired t-test to test the significance of the difference between interproximal and nonproximal gingival index.

** statistically significant $p<0.05$.

surfaces of these teeth (Fig. 2) The resulting indices were mostly normally distributed. Consequently, parametric tests, such as the two-sample *t*-test to compare the mean indices between the magnetized and non-magnetized groups, and paired *t*-test to evaluate differences between facial and lingual or proximal and non-proximal surfaces, were applied. ANOVA was used to compare the differences in the mean indices between the two groups adjusting for age and sex. Furthermore, the Pearson correlation coefficient used was an appropriate measure of association between the Turesky plaque index and Watt accretion index, given that they were interval-scaled variables. Due to the period effect observed, and the assumption of a parallel design, however, the criticism regarding the matching of calculus formation of the subjects remained a problem in our study.

Unlike the previous study by Watt et al. (1993), in which 13% of the patients dropped out due to units malfunctioning, none of the units malfunctioned in our study. None of the study participants dropped out due to the study. One participant exited immediately after the initial appointment, anticipating time constraints, one moved to another country, and the other was hospitalized for an unrelated problem.

It was interesting to note that the older participants stated that they liked the units and actually missed them during the 14-day washout period, whereas the younger subjects were not as enthusiastic. 40% of the younger subjects stated that they did not like the noise level of the units.

The principal investigator (KEJ) felt that the calculus was somewhat softer after using the irrigator. While this may not be a direct result of the hydromagnetic effect, it is a possibility. It would be interesting to examine the use of this irrigator with an antimicrobial rinse such as chlorhexidine which is known to produce an increase in calculus formation (Mandel 1988), to determine if this increase could be prevented. Lang & Räber (1981) documented the use of chlorhexidine in an irrigator to be more effective for the application of chlorhexidine than rinsing.

Water irrigation has been shown to reduce gingivitis as well as rinsing with an antimicrobial agent, but not disclosable plaque (Boyd et al. 1985, Lang & Räber 1981, Lang & Ramseier-Grossmann 1981, Flint et al. 1988). Supragingival irrigation when combined with tooth brushing, as in our study, may be of particular benefit for patients who do not or cannot perform adequate interproximal oral hygiene (Lang & Räber 1981, Lang & Ramseier-Grossmann 1981, Hugoson 1978, Aziz-Gandour & Newman 1986, Gupta et al. 1973, Phelps-Sandall & Oxford 1983, Attarzadeh 1981). However, in our study, a statistically significant reduction in gingival index was found in relation to the nonproximal surfaces as compared to the interproximal surfaces regardless of treatment or period (Table 4). Of further research interest would be evaluating the magnetized oral irrigator's effect on interproximal hygiene, to determine if this unit can in fact replace the need for flossing.

As demonstrated by our results, oral irrigation with a magnetized oral irrigator appears to have a beneficial effect in the periodontal management of patients in supportive periodontal therapy by significantly reducing calculus accumulation. (Mandel & Gaffar 1986, Addy & Koltai 1994).

Acknowledgements

The authors acknowledge the contributions of Dr. David Mishkin, Dr. Tariq Javed, Dr. Frank Young, the assistance of the staff of the Periodontics Clinic, and Don and "D. J." Evans of HydroFloss Inc. for the funding of this research and their technical support.

Zusammenfassung

Die Wirksamkeit eines magnetisierten, für die Mundhöhle vorgesehenen Wasserirrigators (Hydro Floss®) auf den Plaque, den Zahnstein und die Gesundheit der Gingiva

Mit der vorliegenden Studie wurde beabsichtigt, die Wirkung eines, für die Mundhöhle vorgesehenen, magnetisierten Wasserirrigators auf Plaque, Zahnstein und Gesundheit der Gingiva auszuwerten. 29 Patienten nahmen an diesem doppelblinden Überkreuzversuch vom Anfang bis zum Ende teil. Mittels Prophylaxebehandlung der Mundhöhle wurde für jeden Patienten die Eingangssituation der Studie durch Erreichen eines Plaqueindex von ≤1 geschaffen. Die Versuchspersonen benutzten den Irrigator 3 Monate lang mit dem Magneten und 3 Monate ohne ihn. Nach jedem der 3 Monate langen Intervalle wurden die Plaque Index-, Gingivalindex- und Anlagerungs-Indexdaten (Accretions Index), zusammengestellt. Die wiederholte Analyse der Messungen der Plaqueindizes, der gingivalen- und Zahnsteinindizes zeigte für den PII einen statistisch abgesicherten (p=0.0343) Periodeneffekt, für den GI von p=0.0091. Für Zahnsteinanlagerungen näherte sich dieser Effekt einer Signifikanz (p=0.0593). Das bedeutete, daß der Irrigationseffekt im Laufe der Studie den Rückgang aller Indizes erreichte. Darum wurde der Behandlungseffekt für jeden Index nur für die am Ende der ersten Periode erhaltenen Messungen evaluiert (d.h. es wurde eine Parallelanlage angenommen). Im Vergleich zu der Kontrollgruppe verringerte die Irrigationsbehandlung mit magnetisiertem Wasser die Zahnsteinanlagerung um 64%. Diese Reduktion war statistisch abgesichert (p≤0.02). Der Rückgang des Gingivalindex um 27% war statistisch nicht signifikant. Die Plaquereduktion war minimal (2.2%). Zwischen dem Plaqueindex und dem Anlagerungs-Index wurde stark positive Korrelation beobachtet. Der für die Mundhöhle vorgesehene Irrigator mit magnetisiertem Wasser könnte als eine brauchbares Adjuvans zur Vorbeugung von Zahnsteinanlagerung bei parodontal erkrankten Patienten gelten. Seine Wirkung auf die Reduktion des Plaque scheint allerdings nur minimal zu sein. Die Ergebnisse ließen eine, jedoch statistisch nicht abgesicherte, klinische Verbesserung des Gingivalindex erkennen.

Résumé

Efficacité d'un irriagateur buccal à eau magnétisée (HydroFloss®) sur la plaque dentaire, le tartre et la santé gingivale

29 patients ont participé à cette étude croisée en double aveugle. Chaque patient a été rendu parodontalement sain via une prophylaxie buccale; indice de plaque ≤1 et indice gingival ≤1. Les sujets ont ensuite utilisé l'irrigateur durant 3 mois soit avec l'aimant soit sans. Après chaque intervalle de 3 mois les données ont été prises en utilisant l'indice de plaque, l'indice gingival et l'indice d'accumulation. L'analyse des mesures répétées sur la plaque dentaire, la gencive et le tartre a mis en évidence un effet significatif pour l'indice de plaque (p=0.0343) et pour l'indice gingival (p=0.0091), et qui approchait la signification pour le tartre (p=0.0593). L'irrigation entraînait donc une diminution de tous les indices. C'est pourquoi l'efficacité du traitement sur chaque indice a été évaluée en utilisant seulement les mesures obtenues à la fin de la première période c'est-à-dire comme s'il y avait un modèle parallèle. L'irrigation avec l'eau magnétisé a engendré une diminution de 64% du tartre comparé au groupe contrôle. La réduction était significative (p≤0.02). La réduction de 27% de l'indice gingival n'était pas significative. La réduction de la plaque dentaire était minime (2.2%). Une relation positive importante entre l'indice de plaque et l'indice d'accumulation a été observée. L'irrigateur buccal à eau magnétisée pourrait être utile dans la prévention de l'accumulation de tartre chez les patients soignés pour parodontite bien qu'il ne semble avoir

aucun effet sur la plaque dentaire et très peu sur la santé gingivale.

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MAGNETIC TREATMENT OF WATER: POSSIBLE MECHANISMS AND CONDITIONS FOR APPLICATIONS

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Abstract: In this paper, fundamental properties and parameters of water molecules, fine "structure" of water, hydration of ions and nature of the hydrogen bond are reviewed. A model is outlined of possible mechanisms of the effect of relatively weak magnetic fields on the statistically mean number of hydrogen bonds between water molecules, as a result of forbidden triplet–singlet transitions in the Zeeman electron–proton multiplets of the water molecule and its near surroundings. The effect of the influence of the magnetic field on the ion–colloidal subsystems of aqueous environment are analysed. It is shown that the energy of magnetic dipole interaction of colloidal particles of the magnetite type is sufficient for their flocculation and concentration in areas of high gradient of the magnetic field, and for their stability against hydrodynamic disruption of the flocs, possible centres of crystallisation of $CaCO_3$. On the basis of the proposed calculations, and also based on data presented by other authors,particularly from ex–Soviet Union, conditions and regimes of anti–scale magnetic treatment of water are reviewed.

BRIEF CHARACTERISTICS OF WATER MOLECULES

A free water molecule H_2O is a three–nuclei formation. Two electrons $1S^2$ are localised near oxygen, the other eight $2S^2P^6$ move along the lengthened elliptical orbitals. The axes of two orbitals coincide in bonds O–H and axes of the two other undivided electron pairs lie in a plane which is perpendicular to H–O–H and passing through the oxygen nucleus.

Electrostatic model of water molecules can be represented as a regular tetrahedron, in two vortices of which the mass centres of positive charges q_1, q_2 are situated, which are bound to protons, and in tow other vortices there are centres of mass of negative charges e_1, e_2, which are bound to undivided electron pairs. There is an oxygen atom with charge $+Q_o$ at the centre of the tetrahedron.

Table I The main parameters of water molecules

Parameter	Value
Length of O-H bond	$r = 0.96 \times 10^{-10}$ m
Angle H-O-H	$\alpha = 104.523^0$
Dipole moment	d = 1.84±0.02D (6.13×10^{-30}Cm)
Volume magnetic susceptibility (SI)	$\chi_{xx} = 2.46 \times 10^{-6}$
	$\chi_{yy} = 0.77 \times 10^{-6}$
	$\chi_{zz} = 1.42 \times 10^{-6}$
Polarisability	$\beta = 1.48 \times 10^{-30}$ m^3
Ionisation potential	$I_w = 20.11 \times 10^{-19}$ J (12.56 eV)
Force constant in direction of O-H	$k = 8.256 \times 10^2$ N/m
Energy of water formation, 0 K	- 918.333 kJ/mol (9.511 eV)
Energy of O-H bond, 0 K	- 459.205 kJ/mol (4.40 eV)
Energy of dissociation H-OH, 0 K	- 493.205 kJ/mol (5.11 eV)
The lowest energy of vibration	0.198 eV
The lowest energy of rotation	0.005 eV
Thermal energy kT, at T=293 K	2.52×10^{-2} eV
Magnetic moment of proton	$\mu_p = 1.411 \times 10^{-26}$ A m^2
Magnetic moment of electron	$\mu_e = 9.285 \times 10^{-24}$ A m^2
Magnetic induction created by proton at a distance of 10^{-10} m	$1.4 \times 10^{-3} < B_p < 2.8 \times 10^{-3}$ T
Magnetic induction created by electron uncompensated spin moment at a distance of 10^{-10} m	$0.93 < B_e < 1.86$ T

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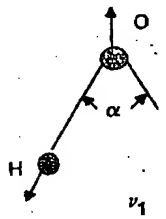

Fig. 1

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The main parameters of water molecules are shown in Table I [1]. The spectroscopic characteristics are depicted in Fig. 1 [2]. Every vibration changes the dipole moment and consequently it is active in the IR spectrum. The valency vibration O–H (weak shoulder) at 25° corresponds to the band 3615 cm^{-1} in the IR spectrum, and 3610 cm^{-1} in the combination scattering spectrum at 19°C.

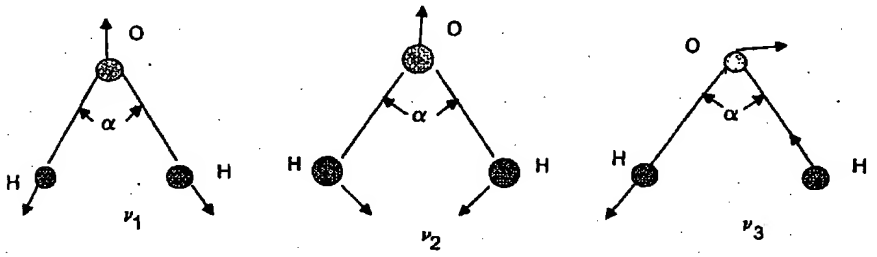

Fig. 1 Normal vibrations of free water molecule ($H_2{}^{16}O$).
$\nu_1 = 3657\ cm^{-1}$, $\nu_2 = 1595\ cm^{-1}$, $\nu_3 = 3756\ cm^{-1}$.

LIQUID WATER AND ITS CHARACTERISTICS

Pure liquid water is a mixture of isotopes $H_2{}^{16}O$, $H_2{}^{18}O$, $H_2{}^{17}O$ and HDO. According to this, the content of components in natural water is within the limits of 99.73, 0.20, 0.04 and 0.03% [1].

Distance between the molecules of liquid water, under normal conditions, which was determined on the basis of X–ray data is taken to be 2.76×10^{-10} m. At this distance, the water molecules interact with one another forming hydrogen bond H...H–O–H arising as a result of the interaction between a proton of one of the molecules and an undivided electron pair of the other molecule. Each molecule can form maximum four such bonds which is proved by X–ray data [1].

It was found that in the temperature interval from 1.5 to 90°C, the number of close neighbours is $q = 4.4$. Water is thus a liquid with a pronounced short–range order arising owing to the hydrogen bonds.

Concept of "Water Structure"

When using the concept of "water structure" [1], its meaning must be defined. In view of the fact that we mean a liquid where the mass centres of molecules can produce not only vibrations but also movements at distances exceeding the diameter of a molecule D_m, the relative position and orientation of water molecules continuously changes. That is why the term "water structure" means the relative position of the water molecules averaged over the observation period $\Delta\tau$ of the configuration of the water molecule. By "observation" we also mean an act of a chemical conversion in water, or the effect of an external field on water.

It is possible to highlight several characteristic times:

–time of vibrations of the centre of mass of the molecules, $\tau_v = 10^{-13}$ s

–time of the rotational movement $\tau_r = 10^{-12}$ s

–time of translation of the centres of mass over distances exceeding D_m, $\tau_t = 10^{-11}$ s.

According to this, the molecule configuration in water obtained from averaging over the period of time $\Delta\tau < \tau_v$ is called *I*–(ice) structure, or momentary structure. The result of averaging over a period $\tau_v < \Delta\tau < \tau_t$ is called the *V* (vibration) structure. A configuration obtained by averaging over a period $\Delta\tau > \tau_t$ is called the *D* (diffusion) structure.

X–ray and neutron–spectrographic experiments provide information about the *D*–structure. The same *D*–structure determines the equilibrium and quasi–equilibrium water properties. At the same time, the ion reactions with the conversion time $\Delta\tau < 10^{-11}$ s are determined by the *V* and *I* structures.

Information about the *V*–structure can be obtained also from a study of infra–red and Raman spectra, or of non–elastic scattering of slow neutrons. Thus, if changes of water have a characteristic time $\Delta\tau > 10^{-6}$s, then only changes of the *D*–structure are meant, which can be determined with the help of corresponding experimental equipment.

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To explain X–ray data, different *V*–structure models are proposed.

1. Nemethy and Scheraga model [3], or the mixed model: a momentary configuration of water at the present moment is a mixture of some number of clusters of water molecules, with completely closed H–bonds and free molecules which are not connected by hydrogen bonds.

2. Samoylov's vacuum model [4], which a special case of the mixed model. It is assumed that in the molecule network with H–bonds, a vacuum is formed which is occupied by free water molecules.

3. Pople's model of distorted hydrogen bonds [5]. It is assumed that all molecules are connected with each other by a flexible network of H–bonds. The dependence of the bond energy on the angle φ of deviation of the hydrogen bond is given by the relation:

$$\Delta U = K\varphi(1 - \cos\varphi)$$

where K is the constant of proportionality. It was found by Pople, from X–ray data, that

$$K = 3.78\times10^{-20}\ \mathrm{J/rad^2}$$

4. A model of occasional network [6] proposed by Bernal. Every molecule forms four bonds producing thus a non–regular network of ring structures. Rings can have 4, 5, 6 or 7 or more molecules.

Both models no. 3 and 4 are similar since they consider not broken but distorted H–bonds. The models describe well the X–ray data, heat capacity and water heat energy, large dielectric constant and mobility of protons, as well as energy of vaporisation.

There are data, however, that are difficult to explain within the framework of these models. This is a small spread of dielectric relaxation time which can be naturally described by mixed models.

CHARACTERISTICS OF THE HYDROGEN BOND

The energy of the hydrogen bond in liquid medium is found as the difference

$$\Delta E_{hb} = E(O–H)–E(O–H....O)$$

where E(O–H) is the energy of the OH group in water, without the H–bond, while E(O–H...O) is the energy of the OH group with the H–bond.

It is clear that the energy of the H–bond found in this way depends on the pressure, temperature and momentary environment of the water molecule, and assumes a range of values [1]:

$$1.3 < \Delta E_{hb} < 4.5 \text{ kcal/mol bonds}$$

or

$$5.64\times10^{-2} < \Delta E < 1.95\times10^{-1} \text{ eV}$$
$$(T = 293 \text{ K}, kT = 2.52\times10^{-2} \text{ eV})$$

Different components contribute to the energy of the hydrogen bond. As a rule [7, 8], the main four components of energy are considered:

1. Electrostatic interaction of one of the undivided electron pairs with one of the protons of the neighbouring molecules. This contribution is considered to be large, about 7 kcal/mol bonds.

2. Electron interchange at approach O–HA...OB; this interchange is accompanied by mutual polarisation of shells. According to the way of calculation, this value changes within one order of magnitude.

3. Repulsion as a result of shell overlap. It is considered that in water this contribution is equal to the first one, as the distance $r_{A–B}$ is less than the sum of van der Waals radii.

4. The dispersion influence is also substantial through it is less than the others; its contribution is $\cong -1.5$ kcal/mol bonds.

It must be said that the energy of the H–bond is very sensitive to the non–local effects on the nearest neighbour state. Formation or break of H–bonds in the neighbouring molecules can increase or reduce ΔE_{hb}. It is important that small energy of the H–bond is a result of adding large contributions of electrostatic attraction and non–local repulsion.

ION HYDRATION

By ion hydration we mean all the changes that take place in the water medium during a process of introducing a molecule or ion into the water. There are two approaches to the process of hydration.

1. It is considered that the main factor in the process of hydration is the interaction of an impurity ion or molecule (admixture) with the molecules of water. Hydrated admixture in this model is a complex "admixture + strongly bonded water molecules".

2. It is assumed that the admixture influences mainly the dynamics and the structure of adjoining water volume and does not form strong–bonded complex with water molecules.

Interaction of ions with water molecules and with each other in the same medium must be studied considering their property to form H–bonds with water and the presence of these bonds between the water molecules. In the case of weak hydration, the admixtures substitute water molecules in the H–bond network, or are placed in its internods. Presence of admixture does not change the structure and the dynamics of the H–network substantially.

Under strong hydration the energy of interaction of the molecule with the admixture is larger than between water molecules. The admixture distorts and

partly breaks down the network of the H–bonds and determines the structure and dynamics of the H–network at a considerable distance.

Samoylov [4] proposed to describe the hydration phenomenon as a change of the mean time τ_i in comparison with τ time of the stationary state of the water molecule in a regular network of the H–bonds. Since the random motion of molecules from their temporary equilibrium positions has an activation character, i.e.

$$\tau = \alpha e^{-E/kT}$$

then we obtain

$$\frac{\tau_i}{\tau} = e^{\Delta E_i/kT}$$

where $E_i = E + \Delta E_i$, k is the Boltzmann constant and T is the absolute temperature.

The following situation are thus possible:

1. $\Delta E_i > 0$, $\tau_i > \tau$, positive hydration

2. $\Delta E_i < 0$, $\tau_i < \tau$, negative hydration

Under positive hydration, the strengthening of the H–bonds in a solution takes place (depression of temperature of the structure), while under negative hydration the H–bonds weaken (temperature of the structure increases).

Concepts of positive and negative hydration can also be used to describe processes of the water molecule sorption border. Table II shows values of the hydration energies ΔE_i (kcal/mol) calculated by [9].

Spectroscopical study of the hydration phenomenon was made by measuring infra–red absorption frequency shift of the deformation vibrations of the O–H group [10]. The authors [10] classified ions by the degree of positive hydration:

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Table II The energy of hydration

Ion	ΔE_i (kcal/mol)
Li^+	0.56
Na^+	0.14
K^+	-0.36
Cs^+	-0.31
NH_4^+	-0.35
Ca^{2+}	0.28
Mg^{2+}	0.8
Ba^{2+}	0.02
Cl^-	-0.21
NO_3^-	-0.44
SO_4^{2-}	0.15

$$Al^{3+} > Cr^{3+} > Be^{2+} > Cd^{2+} > Zn^{2+} > Mg^{2+} > Li^+ > Na^+$$

$$CO_3^{2-} > SO_4^{2-} > OH^- > F^-$$

and by the degree of negative hydration:

$$Cs^+ > K^+$$

$$PeO_4^- > ClO_4^- > I^- > NO_3^- > SCN^- > Cl^-$$

Positive and negative hydration phenomena are also accompanied by dissolution of non–electrolytes in water. Positive hydration of the molecules of dissolved gases can explain the diminishing dielectric permeability of the gas–saturated water, the formation of the gas–hydrates, change of the water solution capacity and so on.

THE EFFECT OF THE MAGNETIC FIELD ON WATER

Water is diamagnetic creating an internal field which is directed antiparallel to the external field with intensity H. The volumetric density of the energy $E(B)$ of free water when it is magnetised is given by:

$$\rho_f(\mathrm{B}) = \frac{\delta \mathrm{E}(\mathrm{B})}{\delta \mathrm{V}} = \frac{1}{2}\,\mathrm{MB}$$

where M is the magnetisation of water; $M = \chi H$, and B is the magnetic induction. For water $\chi = -0.722\times10^{-6}$, and magnetic field used in magnetic treatment is $B =$ 0.3 T, or $H = 2.39\times10^{5}$ A/m. We thus have*:

$$\rho_f(\mathrm{B}) = 2.59\times10^{-2}\ \mathrm{J/m^3} \quad \text{or}$$
$$\mathrm{E(B)} = 4.66\times10^{-7}\ \mathrm{J/mol}.$$

This value of the energy can be compared with the energy of the H–bonds for water, which is found in the interval:

$$5.43\times10^{3} < \mathrm{E_{hb}} < 1.88\times10^{4}\ \mathrm{J/mol}$$

Even for the weakest H–bonds

$$\frac{\mathrm{F(B)}}{\mathrm{E_{hb}}} \approx 0.96\times10^{-10}$$

Thus the diamagnetic effects in the total energy of water are negligible.

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*The above analysis is incorrect. The value of magnetic susceptibility given above (χ=0.722×10^{-6}) is the mass susceptibility in cgs units. The equation for ρ_f(B) is written in SI units and, moreover, magnetic susceptibility in the relationship M=χH is the volumetric susceptibility. The correct value to be used in the analysis is $\chi = -9.035\times10^{-6}$ (SI) (e.g. *Handbook of Chemistry and Physics, 62nd Ed. (1981–1982), CRC Press Inc., Boca Raton, FLA., USA*). The correct values of ρ_f(B) = 0.3239 J/m^3, and of $E(B) = 5.83\times10^{-6}$ J/mol are thus at least an order of magnitude larger than those used by the author. The fact that the magnetic energy is many orders of magnitude smaller than the energy of the H–bond is, however, not affected (*Editor's comment*).

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SPIN MAGNETIC EFFECTS IN WATER

As has been mentioned in Section "Hydrogen bond Characteristics", the break energy of the first H–bond between water molecules is by 0.7 eV higher than the break energy of the second bond. It illustrates the cooperative character of the formation of H–bonds which is conditioned by the re–distribution (polarisation) of the electron cloud of molecules participating in these bonds.

Speaking about re–distribution, we mean that systems of protons and electrons interact with each other satisfying the law of conservation of impulse, of the moment of impulse (complete spin), and of energy. In view of the fact that water is diamagnetic, the minimum of the electron–vibrational energy of the water molecule with the H–bonds is obtain under the condition that its spin state is singlet. It must be noted that this condition does not require a singlet state of the proton spin as a separate system. Thus, it does not require a para–state of the water molecule, but it is necessary that the total spin of the proton ($S[^{16}O_8] = 0$) – electron system forming H–bonds is compensated.

Correlation of the spin of the electron–proton system can be evaluated by their mutual fields. Induction B_e of the magnetic field created by the uncompensated electron spin of molecule B (bond OA–HA...OB) at the position of proton HA is equal to 2 Tesla. Taking into account mutual spin compensation of the paired electrons, then

$$B_e = 2\alpha \qquad \text{[Tesla]}, \ 0 < \alpha < 1$$
$$\vec{B}_e = \alpha \vec{B}_e$$

where $\vec{B}_e$ is the magnetic induction generated by partially compensated electron spins and α is the coefficient of dynamic compensation.

Magnetic induction generated by proton HA in the region of undivided oxygen pairs O_B is $B_p \cong 3$ mTesla. Magnetic induction of the external field used in magnetic treatment is $B \cong 0.2$ Tesla. Thus, for $\alpha = 0.1$ the external magnetic field is commensurable with the field of partly non–compensated spins of an electron pair OB, and can change instantaneous multiplicity of the state. Thus, part of spectrum of the state which forms the H–bond can appear forbidden because of the

spin. The external magnetic field can cause the weakening and statistical average (as to V and D structures) diminishing the H–bond number between water molecules, and thus affecting its structure and consequently its reaction ability.

It must be noted that the proposed mechanism of the effect of the external magnetic field on the process of the dynamic formation of H–bonds is based not on the energy effects but is secured, as it takes place in the spin–radical reaction with the participation of the field [11], by the law of conservation of the total spin of the interacting particles.

It is quite probable that the external field affects, in the most efficient way, only those states of the electron–proton system which form the H–bond during the time that is less than that associated with the time of the thermal vibrations, namely $\tau < 10^{-13}$ s. We must also note that under this mechanism of the effect of the magnetic field the values of the effective magnetic induction are in the range 3 mT < B < 1000 mT.

MAGNETIC FIELD INFLUENCE ON THE ION AND COLLOID SUBSYSTEMS

It has been already mentioned that the diamagnetic interaction of the water itself with magnetic field can hardly be related to technological effects including the anti–scale effect.

Let us investigate the effect of the magnetic field on a system of impurities in the water medium. It consists of neutral and charged particles, molecular and colloidal dispersibility degree. Some of the particles can acquire non–compensated spin magnetic moment, other particles can be diamagnetic, as for instance $CaCO_3$, which has a pronounced anisotropy of diamagnetic susceptibility [12]:

$$\chi_{\perp} - \chi_{\parallel} = 4.02 \text{ to } 4.89 \times 10^{-6}$$

where $\chi_{\perp}$ and $\chi_{\parallel}$ are perpendicular and parallel components of magnetic susceptibility. The anisotropy is determined by the type of the crystalline system

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(orthorhombic or trigonal). The ions widely found in natural waters are also diamagnetic, as is shown in Table III. Oxygen is paramagnetic, and $\mu_{O2} = 2\mu_B$, where μ_B is the Bohr magneton, equal to 9.274×10^{-24} Am^2.

In view of technological magnetic effects, the colloidal particles exhibiting ferro–, ferri–, antiferro– and superparamagnetic properties are the most interesting. It is known [12, 13] that when particles reach a critical radius $R_{cr} = 0.5$ to 1.0×10^{-8} m,

Table III Magnetic susceptibilities of diamagnetic ions

Ion	$\chi \times 10^6$ (SI)
Mg^{2+}	-3.2
Ca^{2+}	-10.4
K^+	-14
Na^+	-6.5
NO_3^-	-20.1
SO_4^{2-}	-35.2
CO_3^{2-}	-28.1
CO_2	-4.23

they behave in the external magnetic field as mono–domain particles. The saturation magnetisation of these particles is equal approximately to 0.05 T, while for multi–domain particles the saturation magnetisation amounts to about 0.2 T. Magnetic moment of mono–domain particles is comparatively large:

$$\mu_s = 2.5 \text{ to } 9.0 \times 10^{-18} \text{ Am}^2$$

In the external magnetic field, the magnetic moment rotates around the field while a particle itself rotates in the water medium. Behaviour of a system of mono–domain particles in the external magnetic field was investigated in [14, 15]. When the size of a particle decreases further, i.e. $R < 0.5 \times 10^{-8}$ m, particles lose their ferromagnetic properties and turn into a superparamagnetic state [16]. Paramagnetic susceptibility in this state is $\chi \approx 10^{-4}$ to 10^{-3}.

An estimate of the interaction energy of the magnetised monodomain particles at a distance r = 10^{-8} m gives $E_m \cong 2.5\times10^{-18}$ J, or $E_m/kT \cong 15$. Thus such particles flocculate immediately and form chain structures. It must be noted that for concentration of particles from 10^{15} to 10^{18} m^{-3}, the average distance between them is 10^{-5} to 10^{-6} m, and their interaction energy is several orders of magnitude lower than the thermal energy.

Thus, to obtain an effective flocculation of magnetic particles, their concentration must increase. It can be provided by ponderomotive forces acting in non–homogeneous magnetic field on magnetisable particles. The condition of concentration of magnetisable spherical particles in a liquid stream can be expressed as:

$$\frac{F_m}{F_d} \geq 1$$

where $F_{mi} = \mu \frac{dB}{dx_i}$ is the magnetic force on a particle and $F_d = 6\pi\eta r_o v$ is the hydrodynamic drag. r_o is the radius of a particle, η is the coefficient of the dynamic viscosity of water, v is the velocity of the water flow and μ is the magnetic moment of a particle.

Assuming T = 20°C, $\eta = 10^{-3}$ kg/m.s, we obtain

$$2.6\times10^{-6}\frac{dB}{vdx} \geq 1$$

Consequently, taking into account real velocity profile in a channel, the concentration condition is satisfied in a thin wall layer of 10^{-4} to 10^{-3} m of the channel of the magnetic device. The corresponding effects of concentration of ions or electrodipolar particles by electrodynamic forces are by 2 to 3 orders of magnitude lower.

It thus seems probable that effects of changes of dispersion of the colloidal suspension in natural and technical waters during their magnetic treatment, including the anti–scale effects are caused mainly by suspensions of particles that have have magnetic moments which are sufficient to resist hydrodynamic and thermal destruction. Naturally, the mechanism of magnetic treatment of

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Fig. 2

ferro–admixtures does not exclude the effect of the magnetic force on the water structure as discussed in previous section.

QUANTITATIVE ESTIMATE OF THE CONCENTRATION EFFECTS IN ION–COLLOIDAL SYSTEMS IN MAGNETIC DEVICES

Majority of studies [17] which try to explain the effect of magnetic treatment propose to consider the magnetic device as a magnetohydrodynamic unit in which Lorentz force F_L is the driving force. The electrolyte movement in the cross magnetic field causes a cross ion current which produces a concentration of ions with opposite sign in the vicinity of the opposite walls of the channel of the magnetic device. The situation is depicted in Figure 2.

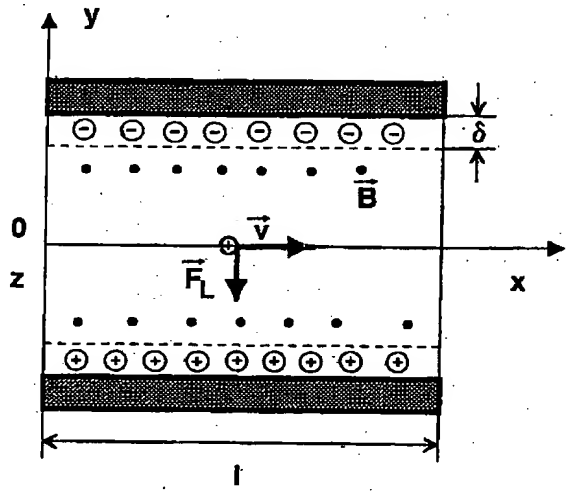

Fig. 2 Cross section through a rectangular channel of the magnetic device. Magnetic induction B denoted by dark circles is perpendicular to the plane of the channel (B ∥ OZ) while ℓ is the length of the magnetic zone and δ is the thickness of a layer of concentration of ions and charged colloidal particles.

In the case of a rectangular section of the channel in the YOZ plane which is oriented along the OX vector (vector B || OZ), the change of the ion concentration near the wall perpendicular to YO is given, in the non–diffusion approximation, and ignoring the Hall field, by the expression [18]:

$$\frac{\Delta n(x,y)}{n_0(y)} = \alpha x \frac{\{\ln[n_0(y)v(y)]\}}{dy}$$

$$\alpha = \frac{qBD}{kT}$$

In the above equations, $n_0(y)$ is the distribution of ions at the entrance into the channel, Δn is the change of the concentration of ions as a result of the action of the magnetic field, q, k and D are the ion charge, Boltzmann constant and the ion diffusion coefficient (for instance, for CO_3^{2-} or Ca^{2+} in solution), respectively, and $v(y)$ is the mean velocity in the channel of the magnetic device. For Ca^{2+} and CO_3^{2-} ions at T = 300 K $\alpha = 10^{-7}$to 10^{-8}.

Using a parabolic profile of the flow velocity:

$$v(y) = v_0 [1 - (y/d)^2]$$

where d is the radius of the channel and v_0 is the flow velocity at y = 0, we get, for $n_0(y) = n_0 = \text{const.}$:

$$\frac{\Delta n(x,y)}{n_0(y)} = -\alpha \frac{2xy}{d^2 - y^2}$$

This expression allows to estimate the amplitude of relative change of the ion concentration in the wall layer of thickness δ. Assuming that $y = d - \delta$, $x = \ell$, length of the channel of the magnetic device, and bearing in mind that $\delta/d \ll 1$, we obtain

$$\frac{\Delta n}{n_0} = \frac{\alpha \ell}{\delta}$$

Consequently, in order to attain $\Delta n \cong n_0$, it is necessary that $\delta = 10^{-7}$ to 10^{-8} m, at $\ell = 0.1$ m. Thus, an appreciable change of concentration ($\approx 10\%$) of ions, as a result of magnetohydrodynamic effects, appears in the wall layer of thickness $\delta =$

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10^{-6} to 10^{-7} m. It is easy to see that a change of the ion concentration in such a thin layer cannot essentially affect the crystallisation process of $CaCO_3$ in the magnetic device.

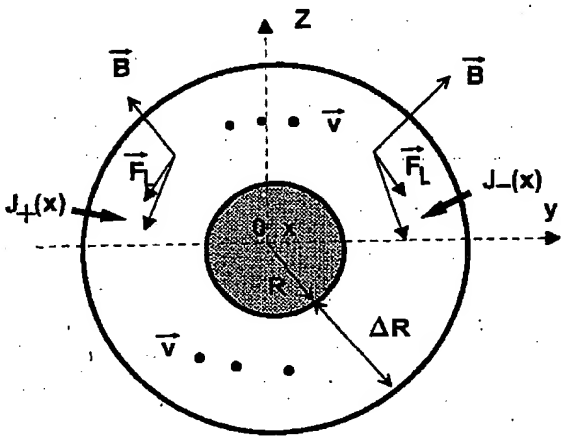

Fig.3 Cross section of the cylindrical channel of the magnetic device. The fluid moves along the OX axis, v ∥ OX, the magnetic induction B is oriented radially, $J_+(x)$ and $J_-(x)$ are the flux densities of positive and negative ions created by the action of the Lorentz force.

There is another condition associated with the Lorentz force, which is worth of attention. In a circular channel of a magnetic water device, with radial magnetic field $B_r(x)$, it is assumed that that the field is not homogeneous along the axis OX of the channel. The vortex current this arises whose dissipation energy can be easily calculated. We have, for the tangential component of the vortex current density:

$$J(x) = GE_\tau(x) = Gv(x)B_r(x)$$

where v is the mean velocity of the water flow, G is the specific electrical conductivity of the treated water.

According to this, a specific power of the vortex current energy dissipation is equal to:

$$\frac{dW}{d\Omega\, dt} = G(x)v^2(x)B_r^2(x)$$

where W is the energy of dissipation of the electric current generated by the Lorentz force, while Ω is the volume of a channel of the magnetic unit. From the above, power released in the working space of the device is given by:

$$\frac{dW}{dt} = \int_0^{2\pi}\int_{R_1}^{R_2}\int_0^{L} G(x)v^2(x)B_r^2(x)\rho dx d\varphi d\rho$$

and complete work done by permanent stream of water is

$$W = 2\pi R\Delta R\int_0^{L} G(x)v^2(x)B_r^2(x)dx\int_0^{L}\frac{dx}{V(x)}$$

where L is the length of the channel, R is the radius of channel and ΔR is its height. For a cylindrical channel with the side surface R, $R + \Delta R$, under the condition that $v(x) = \text{const.}$, $G(x) = \text{const.}$, and we obtain:

$$W = \Omega G v L B_r^2; \qquad B_r^2 = \frac{1}{L}\int_0^{L} B_r^2(x)dx$$

For realistic values $R = 10^{-1}$ m, $\Delta R = 10^{-2}$ m, $L = 10^{-1}$ m, $v = 2$ m/s, $B = 0.2$ T, $G = 10^{-2}$ Sm, we find that $W = 5\times10^{-8}$ J.

Assuming that the work of formation of the crystallisation centres $\Delta A = 10^2$ kT, with efficiency $\zeta = 0.01$, then the number of the centres formed at $T = 300$ K is:

$$N_{cc} = \frac{5\times10^{-8}}{10^2 kT}\eta = 10^9$$

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$$\beta(r) = \frac{1}{v}$$

which gives the concentration per unit volume:

$$n_{cc} = \frac{N_{cc}}{\Omega} = 1.6\times10^{12}\ \mathrm{m}^{-3}$$

If we assume that, on condition of over–saturation, the crystallisation centres entering a heat exchanger reach the size of a $\cong 0.5\times10^{-6}$ m, and it is possible to obtain their specific surface

$$S_{cc} = 4\pi a^2 n_{cc} = 5.0\ \mathrm{m}^{-1}$$

This can be compared with specific surface of a standard pipe of a heat exchanger, with inside diameter of 1.8×10^{-2} m, $S_{pipe} = 1.11\times10^{2}\ \mathrm{m}^{-1}$. Thus, the anti–scale effect will represent approximately 5 per cent.

Besides by Lorentz forces, the colloidal particles (if they are charged) are affected by the gradient ponderomotoric forces of both magnetic and electrical nature. Estimation shows that the electric gradient forces can be neglected in comparison with the magnetic forces.

Therefore, when considering a cylindrical channel of circular cross–section, oriented along the OX axis, with radial magnetic field, it is possible to obtain (if the diffusion process is neglected) an expression for the change of the concentration of particles on the walls of the channel:

$$\frac{\Delta n(x,y)}{n_0(r)} = \epsilon(r)\,\frac{1 - e^{-b(r)x}}{1 - \epsilon(r)[1 - e^{-b(r)x}]}$$

$$\epsilon(r) = \frac{\mu \dfrac{dB_r}{dx}}{6\pi\eta r_0 v(r)} \qquad b(r) = \frac{6\pi\eta r_0}{mv(r)}$$

where m and r_0 are the mass and the radius of a particle, respectively, and x is the coordinate along the channel axis. For realistic values of r_0, m, η, μ and dB/dx we obtain, in SI units:

$$\beta(r) = \frac{10^6}{v(r)}; \qquad \epsilon(r) = \frac{10^{-4}}{v(r)}$$

It thus transpires from the above that $\Delta n(x,r)/n_0(r)$ reaches its maximum along the OX axis at a distance of 10^{-6} to 10^{-5} m from the channel entrance, i.e. almost instantaneously. Thus

$$\max \frac{\Delta n(x,r)}{n_0(r)} = \frac{\epsilon(r)}{1 - \epsilon(r)}$$

From the last formula we find that concentration of magnetic particles changes substantially in the wall layer with thickness of $\delta = 10^{-4}$ to 10^{-3} m. Rapid flocculation is thus possible in the wall layer of the magnetic device, and generation of supercritical crystallisation centres $CaCO_3$ is probable.

It must be stressed that for the magnetic flocculation mechanism of magnetic treatment of water to be effective, magnetisable particles must be present. As a rule, colloidal particles of magnetite Fe_3O_4 are those that are needed. Conditions of thermodynamic stability of magnetite in water medium are determined by Purbe diagram [19]. In the {Eh, pH} plane the values

$$-0.8 \text{ V} < \text{Eh} < -0.2 \text{ V}; \qquad 7 \leq \text{pH} \leq 14$$

correspond to the zone of magnetite stability. It corresponds to the alkali medium and presence of Fe^{2+} in water.

Such conditions do not often occur in nature. Natural magnetite can arise as a result of bioprocesses or be formed in deep underground waters. Probability of the magnetite formation in a feed water into low–pressure boilers is not high though our studies have shown that approximately 20 to 30 per cent of deposit from ferrous boiler water passed through a filter paper (blue or white strips) exhibits pronounced ferromagnetic properties.

It was described in [20] that the formation of magnetite had been experimentally observed in a magnetic unit and a heat exchanger supplied with magnetised water. Formation of ferromagnetic particles formed in magnetic devices was also observed by streaming ultramicroscopy [21] and using a laser television analyser [22]. In these publications the number of registered particles in the size range 10^{-7} to 10^{-6} m increased during the magnetic treatment by a factor 2 to 8. The authors stressed

the necessity of direct contact of the magnetised water with steel components of a magnetic unit.

HYDRODYNAMIC AGENT IN MAGNETIC TREATMENT OF WATER

The agent affecting the stability of the flocculated particles, and ultimately their ability to become crystallisation centres of the scale–forming compounds, namely $Ca(Mg)CO_3$ and $Ca(Mg)SO_4$, is the hydrodynamic regime of the water in the magnetic device, in the transportation path to a heat exchanger and in the heat exchanger itself.

Taking into account that flocculation occurs only in a thin layer under the surface, with thickness of $\delta \cong 10^{-4}$ to 10^{-3} m, it is important that intense exchange of colloidal particles between the stream core and the wall layer takes place as a result of turbulent diffusion in the magnetic device. In the transportation path, the stream regime must not destroy the flocs, and in the heat exchanger itself the conditions must be similar to those in the magnetic device, namely that turbulent mixing of the medium is necessary not to create over–saturation in the vicinity of the walls of the heat exchanger.

It is clear that in case of special ability of the wall of the heat exchanger to absorb a suspension (bio–coating, electropotential etc.) intense repeated scale formation is possible. As transpires from the above, the hydrodynamic regime must provide good fluid mixing and must not lead, at the same time, to the destruction of the flocs. Physically it means the following: the energy of the hydrodynamic turbulent pulsation must not be larger than the work required to destroy the flocs.

Let us estimate the situation when the above condition is satisfied. The above condition can be written as:

$$\rho \frac{v_\lambda^2}{2} < \frac{U_\varphi}{\nabla \varphi}$$

where ρ is the density of water, v_λ is the velocity of pulsation corresponding to the

scale of pulsation λ, U_φ is the energy of the floc bond, V_φ is the volume of the floc.

Taking into account [23] that

$$v_\lambda = v\left[\frac{\lambda}{\ell}\right]^{1/3} \qquad \ell = \frac{D_h}{m_t} \qquad m_t = \frac{\lambda_h Re}{64}$$

where v is the mean flow velocity, D_h is the hydraulic diameter of the channel through which the liquid is flowing, m_t is the scale of turbulence, Re is the Reynolds number and λ_h is the hydraulic coefficient of friction. According to Blasius

$$\lambda_h = \frac{0.3164}{Re^{1/4}}$$

Using these relations we can obtain the value of the energy of pulsation of the water medium in a volume of a floc with radius a:

$$U_{cr}^{\lambda} = 1.95\times10^{-2}\,\pi a^3 v\rho Re^{1/2}\left[\frac{\lambda}{D_h}\right]^{2/3}$$

Assuming the following experimental conditions: $a = 10^{-7}$ m, $v = 1.3$ m/s, $Re = 2.6\times10^4$, $\rho = 10^3$ kg/m^3, $\lambda = 10^{-7}$m, $D_h = 10^{-2}$ m, we find

$$U_{cr} \cong 0.1 \text{ eV} \gg kT, \quad kT \text{ (at 300 K)} = 2.52\times10^{-2} \text{ eV}$$

Thus the energy of the hydrodynamic velocity pulsation is, in these circumstances, comparable to the magnetic dipolar energy of interaction which is at this distance equal to 0.08 eV.

Let us further define a connection between magnetic and hydrodynamic parameters of the process of magnetic treatment, which ensures efficient flocculation of magnetisable particles.

1. Magnetisable particles must be magnetised, consequently $B >$ 0.05 T.

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$U_{cr} < U_i$

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magnetic mome

$$M = \frac{\mu}{V}$$

where V_μ is th
efficient floccul

$M \geq 1.32$

Using the relati
Re [23] we obta

$M \geq \beta v\rho$

$Re < 35$

2. The concentration condition must be observed, i.e. $\epsilon(r) \cong 1$, or in the wall layer $v(r) \cong 10^{-4}$ m/s.

3. It is necessary for intense turbulent mixing of the fluid to take place, i.e. $D_{turb} \gg D_{heat}$, where D_{turb} and D_{heat} are the diffusion coefficients for turbulent and thermal mixing, respectively.

4. Hydrodynamic pulsations must not destroy magnetically flocculated particles.

Let us explore the last condition thoroughly. To do so we shall use an equation

$$U_{cr} < U_m; \qquad U_m = \frac{2\mu^2}{a^3} \times 10^{-7}$$

where U_m is the energy of the magnetic interaction of two parallel dipoles having a magnetic moment μ. Magnetisation of a particle is given by:

$$M = \frac{\mu}{V_\mu} = \frac{3\mu}{4\pi a^3}$$

where V_μ is the volume of a particle with magnetic moment μ. Condition of the efficient flocculation can be written as:

$$M \geq 1.32 \times 10^3 v \rho^{1/2} Re^{1/4} \frac{\lambda^{1/3}}{D_h^{1/3}}$$

Using the relationship between the scale of pulsation λ and the Reynolds number Re [23] we obtain, for hydraulic smooth pipes:

$$M \geq \beta v \rho^{1/2} Re^{1/4}$$

$$Re < 35 \frac{D_h^{2/3}}{a_{cr}^{2/3}}$$

$$\beta = 7.81\times10^{3}\ [\frac{\mathrm{C\,kg^{1/2}}}{\mathrm{m^{7/2}}}]$$

where a_{cr} is the critical size of a centre determined by the equation [24]:

$$a_{cr} = \frac{b(a)}{\ln\gamma - \frac{U(a)}{kT}}$$

$$b(a) = \frac{2G(a)\xi(a)}{\rho(a)RT}$$

where $\xi(a)$, G(a) and $\rho(a)$ are the mole mass, surface energy and density of centres of size a, respectively. $U(a)$ is the potential energy of interaction of a scale–forming element (molecules $CaCO_3$ or ions Ca^{2+}, CO_3^{2-}) with the crystallisation centres of radius a, and γ is the coefficient of over–saturation of the medium. Thus the following equations control the interval of values of parameters of the magnetic treatment, in which the process can be efficient:

$$B > 0.05 \text{ Tesla}$$
$$M \geq \beta v \rho^{1/2} Re^{1/4}$$

$$Re < 35\,\frac{D_h^{2/3}}{a_{cr}^{2/3}}$$

According to the equations given above, the parameters characterising the process of magnetic treatment are the following:

magnetic induction B
magnetisation M of the magnetisable particles
flow velocity v of liquid in the magnetic device
density ρ of the liquid
Reynolds number Re
hydraulic diameter D_h and length L of the channel of the magnetic unit
over–saturation coefficient γ of the medium
temperature T
critical size a_{cr} of the crystallisation centres.

REQUIREME
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Yu. V. Myagk
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REQUIREMENTS FOR A REGIME OF THE TREATMENT AND FOR DESIGN OF THE MAGNETIC DEVICES

These requirements developed by various authors transpire from theoretical pre–conditions and from the level of understanding of the processes occurring in the water environment and of the mechanisms of the anti–scale magnetic treatment, as well as of the corresponding requirements.

Yu. V. Myagkov [25] assumes that the effect of the anti–scale magnetic treatment is based on an increase in the probability of formation of molecules $CaCO_3$ (or $MgCO_3$ and $MgSO_4$), as a result of the opposing movement of cations and anions produced by Lorentz forces.

Considering the opposing drift of the ions, product of the magnetic induction B and the length L of the active zone must be within the range 0.1 to 0.2 Tm:

$$Z = BL = 0.1 \text{ to } 0.2 \text{ [Tm]}$$

The same study proposes to use the anti–scale magnetic treatment only for over–saturated water with concentration of magnetisable particles:

$$C_f < 0.5 \text{ mg/dm}^3$$

The flow regime in the treatment zone is supposed to be optimum.

Using data from numerous installations of magnetic devices on ships and small boilers, the authors of [26] proposed an empirical formula which can be used to determine the optimum regime of the anti–scale magnetic treatment:

$$H = \beta \frac{L_o v_o^{1/2}}{L_q v_o^{1/2} n} [A + D(\alpha H_g - 1)]$$

where $A = 171$ kA/m, $D = 58.9$ kA/m, $0.1 < \beta < 1$, $L_o = 0.18$ m. L_q is the length of the active zone of the magnetic field, n is the number of zones of the magnetic field, v is the water flow velocity, H_g is the hardness in meqv/dm^3.

$$\alpha = \frac{[Ca^{2+} + Mg^{2+}]}{[Ca^{2+}]}$$

The authors of [27] confirm that magnetic treatment changes the rate of dissolution of CO_2 in water and destroys equilibrium of carbon dioxide changing the kinetics of dissolution of $CaCO_3$ or $CaSO_4$. A proposition was made to use magnetic treatment to remove the existing scale. For $H_g \cong 0.4$ meqv/dm^3, $v = 2.4$ m/s $B = 100$ mT is suggested.

An original approach to the mechanism of the anti–scale magnetic treatment is discussed in [20]. "water–pipe–line metal" system is considered as a magnetothermic couple, the cold end of which in the magnetic device generates the ion current, closed in the heat exchanger, polarising the surface of the heat exchanger and thus protecting it from scale.

The efficiency of the magnetic device is proposed to be determined by a difference between the potentials of the magnetic device and the heat exchanger. There are no concrete proposals as far as the regimes of the anti–scale magnetic treatment, and construction of the magnetic device are concerned. Nevertheless, an efficient application of the original construction of the magnetic device in the evaporating ship devices is described.

Considerable factual material about the applications of magnetic devices in heating systems, power engineering and industry is given in papers [28] and [29]. The authors point out that magnetic induction B < 50 mT is not effective, as we discussed above. At the same time, the anti–scale magnetic treatment in magnetic field $B \cong 0.4$ to 0.5 T attains the efficiency of 60 to 80 per cent, when applied in heaters and low–pressure boilers.

Publication [29] underlines efficient performance of a magnetic device with pulse field with the frequency ν ranging from 3 to 10 Hz, and the number of the active zones of the magnetic field $n = 4$ to 8. It is claimed that the anti–scale magnetic treatment is efficient for water with

$H_g = 1.5$ to 8.0 meqv/dm^3
$H_g = 1.0$ to 4.5 meqv/dm^3

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$$\frac{[Na^+]}{[Ca^{2+}}$$

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while the water flow velocity in the treatment zone is recommended to be

$$v = 0.5 \text{ to } 2.5 \text{ m/s}$$

Besides, the author of [29] proposes to install magnetic devices at a distance of $L \leq v\tau$, where $\tau = 60$ seconds. It should be pointed out that in [21] the technique of ultramicroscopy allowed to observe particles of $CaCO_3$ and $MgCO_3$ which arise during magnetic treatment and are preserved in water for two to three days.

Publication [30] gives the most detailed analysis of conditions and regimes of the anti–scale magnetic treatment. It is noted that the requirements must be divided into the following sections:

–requirements for water system
–requirements for the treatment regime and water transport in a heat exchanger
–requirements for the heat exchanger and its operating regime
–requirements for the mode and position of installation of a magnetic device.

1. Requirements for water system are considered in [30] and [31]. It is found that magnetic treatment is expressed in the best way under the following parameters of the water:
General salinity $S \cong 1000$ to 1500 mg/dm^3, $H_g < 10$ meqv/dm^3

$$\frac{H_g}{H_{carbon}} < 1.4 \text{ to } 1.5 \qquad \frac{[Mg^{2+}]}{[Ca^{2+}]} < 0.2$$

$$\frac{[Na^+]}{[Ca^{2+}]} < 2 \qquad \frac{[Cl^-]}{[HCO_3^-]} < 0.5 \qquad \frac{[SO_4^{2-}]}{[HCO_3^-]} < 0.5$$

$$0.03 \text{ mg/dm}^3 < C_{f,gen} < 1.0 \text{ mg/dm}^3$$

where $C_{f,gen}$ is the concentration of general ferromagnetic particles.

The most preferable temperature of the magnetic treatment is between 10 and 45°C. Water must be over–saturated with compound responsible for scale formation, e.g. $CaCO_3$. In this case

$$\gamma = \frac{[Ca^{2+}][CO_3^{2-}]\, f_a^2}{J_{CaCO_3}} > 4$$

where f_a is the activity of ions and J_{CaCO_3} is the solubility of $CaCO_3$ in water.

2. Requirements for the regime of treatment.
It transpires from analysis of large amount of data obtained from successful applications of anti–scale magnetic treatment [28, 29, 30], and from theoretical analysis that the following conditions must be met:

2.1 Magnetic induction in the channel of a magnetic device must be in the interval $0.1 < B < 0.6$ T.

2.2 Gradient of the magnetic field $dB/dx > 50$ T/m

2.3 The magnetic field can be either permanent or pulse. For the pulse field the frequency must be in the interval $3 < \nu < 10$ Hz.

2.4. The length of the zone of treatment $L = 0.15$ m and 60 per cent must correspond to a zone with $dB/dx > 5$.

2.5 For salinity $S > 500$ mg/dm^3, $B > 0.2$ T.

2.6 The desirable flow velocity in the zone of the magnetic field: 0.5 m/s $< v < 5$ m/s. The following relationship is a more precise criterion:

$$3.0\times10^{-2}\ [m^2/s^{3/2}] \le v^{3/2}D_h^{1/2} \le 12\times10^{-2}\ [m^2/s^{3/2}]$$

where D_h is the hydraulic diameter of the channel of the magnetic device.

2.7 Specific surface of the channel $\Omega = S/V$ where S and V are the surface and the volume, respectively, of the channel [30]:

$$2\times10^2\ m^{-1} \leq \Omega \leq 6\times10^2\ m^{-1}$$

3. Requirements for heat exchangers and their operating regime.
It is considered that magnetic treatment is efficient for heat exchangers where specific heat transfer surface

$$\Omega_{HE} \leq 2.5\times10^2\ m^{-1}$$

and heat loading

$$\frac{dQ}{dS\,dt} \leq 3\times10^2\ kW/m^2$$

while the surface boiling must be absent. Special attention during the application of the magnetic device to a heat exchanger must be paid to anti–sludge measures [25]. To achieve this, we must increase the number of boiler blow–offs two to three times, or to use a by–pass sludge separation for the circulation system.

4. Position of installation must be chosen so that the residence time in the heat exchanger of the magnetically treated water does not exceed 60 seconds. The flow regime during transportation must be transitive.

There are many other factors that effect the efficiency of the anti–scale magnetic treatment, for instance season variations of the water quality, floating currents in pipe–lines, vibration of pipes, local liquid turbulence, composition and concentration of suspended particles, level of saturation with CO_2 and O_2 gases, surface–active substances and others. All these factors are also responsible for

possible failures of anti–scale magnetic devices. Nevertheless, according to our research [18] and data obtained by other investigators [28, 29], in more than 60 per cent of cases the magnetic devices installed in the territory of the former USSR were effective (i.e. quantity of scale was reduced by a factor of two or more). In the former East Germany and Czechoslovakia, the efficiency of the anti–scale magnetic treatment in 1980–1983 was 75 to 80 per cent.

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Keywords: water, magnetic treatment, hydrogen bond, anti–scale effect, ion–colloidal system

processing Solutions

PILOT PLANT CORP.

October 1, 2002

Lorraine Mignault
Suite 3209 – 197C Victor Lewis Drive
Winnipeg, MB
R3P 2A4

To whom it may concern:

The POS Pilot Plant Corporation (POS) is a contract scientific research organization that assists companies worldwide in fast tracking the development of new products. For 25 years, POS has enabled the successful transfer of innovation through to commercialization (see attachment).

As Senior Scientist at POS, my responsibilities lie mainly in developing lab and pilot scale processes for extraction and purification of natural components for use in end products such as food, nutraceuticals and cosmetics. I have been involved in the development of such products for a total of 10 years at POS (see attached curriculum vitae).

On January 28, 1998, Ms. Mignault (the client) signed a Confidentiality Agreement with POS (the contractor) which was then followed by a Contract For Service on May 21, 1998 to further develop a natural skin cleansing lotion that would be compatible and complementary to the natural skin care lotion produced by the client. I was on the team involved in carrying out Ms. Mignault's project.

In executing this project it was required to prepare a sample of the client's skin care lotion formulation and identify effective scale-up equipment and process parameters. The lotion was initially prepared using the de-ionized water source at POS. The client expressed concern on the use of the POS water and requested a sample of skin care lotion be prepared using water supplied by the client identified as "magnetized water". According to the client, the magnetized water was prepared by passing it through a Teledon magnetic filter (Teledon of Canada Ltd., Burnaby, BC). Analysis of the client's water sample on July 28, 1998, showed a pH value of 7.50 and conductivity of 152 µohm. In comparison, the de-ionized water supply at POS had a pH of 5.79 and conductivity of 2.2 µohm.

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POS Pilot Plant Corp., 118 Veterinary Road, Saskatoon, Saskatchewan, CANADA S7N 2R4
Telephone (306) 978-2800 · FAX (306) 975-3766 · Email: pos@pos.ca · http://www.pos.ca

On July 28 and July 29, 1998, POS produced two samples of the client's skin care lotion (oatstraw steeped in water with added compounds of vegetable glycerine and lavender oil). One sample of skin care lotion was prepared using the client's magnetized water and the second sample was prepared using the POS de-ionized water supply. The resulting skin care lotion samples were assessed by subjective evaluation by the project staff and by the client.

I felt the skin care lotion prepared using the water supplied by the client (identified as magnetized water) was more effectively applied and absorbed through the skin in comparison to the same formula prepared using the de-ionized water supplied at POS. This observation was in agreement with that of the client.

I make this solemn declaration conscientiously believing it to be true and knowing it is of the same force and effect as if made under oath.

Sincerely,

R. Green

Richard Green, M.Sc.
Senior Scientist

CURRICULUM VITAE
OF
RICK GREEN

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SUMMARY OF EXPERIENCE

August, 1997
to Present

Senior Scientist
POS PILOT PLANT CORPORATION, Saskatoon, SK

Project activity primarily involves the development of laboratory and pilot plant scale processes for bioactive component extraction, fractionation and purification for use in foods, functional foods and nutraceuticals.

Other client driven project work includes cereals processing, product development, protein and carbohydrate processing.

Specialize in unit operations of various drying technologies, filtration, membrane technology and centrifugation.

Responsible for the supervision and management of the research and development of Technicians and Project Associates (8 staff).

November, 1994
to August, 1997

Scientist, Product and Process Development and Manager of Wax Plant Operations
ALBERTA HONEY PRODUCERS CO-OPERATIVE LTD., Spruce Grove, AB

Develop new and modified products and processes for honey and beeswax. Also investigate the potential for products such as pollen and propolis to add further value to the beekeeping industry.

Provide technical support to honey and beeswax processing operations as well as industrial customers for honey and beeswax applications and product development.

Daily management of beeswax processing operation including production, administration and laboratory personnel.

Responsible for commissioning of the beeswax operation. Crude beeswax was received and processed to meet US Pharmacopeia specifications for the cosmetic, food and pharmaceutical industries. Non-pharmacopeia grade wax was dyed for the craft industry.

Develop instrumental methods of analysis for chemical residues in honey and beeswax.

February, 1993 to November, 1994

Scientist, Food Product Development
POS PILOT PLANT CORPORATION, Saskatoon, SK

Involved the development of new and modified products produced from cereals, legumes, oilseeds, fruits, milk, meat and fish.

Optimized food formulations using microcomputer aided statistical experimental design.

Applied analytical methods to assess the physical, chemical, nutritional and microbiological quality of foods. Conducted sensory evaluation tests to determine food quality and carried out shelf-life studies on the new products.

Developed quality control programs for existing and new food products.

April, 1989 to February, 1993

Scientist, Food Processing
POS PILOT PLANT CORPORATION, Saskatoon, SK

Conducted laboratory and pilot scale processing studies to develop new processes for commercial application.

Specific processing technologies evaluated at the pilot scale included spray drying, freeze drying, drum drying, microwave drying, various concentration/evaporation operations and flavour extraction and encapsulation.

Conducted studies to characterize the functional properties of proteins, lipids, starches, carbohydrates and hydrocolloids in food systems. Performed hydration, cooking and drying kinetic studies on various cereal products.

Developed processing protocols for new product concepts and determined equipment specifications for processing the food.

Developed processing protocols for oil and wax products using conventional vegetable oil refining technologies.

Carried out process optimization studies using statistical experimental methodologies.

April, 1988 to April, 1989

Food Scientist, Product and Process Development
ONTARIO CENTRE FOR FARM MACHINERY AND FOOD PROCESSING TECHNOLOGY, Chatham, ON

Involved product and process development of various foods, mainly fruits, vegetables and meats.

Technical work and management of a research project on modified atmosphere packaging of fruits and vegetables.

Performed instrumental analysis of foods using high performance liquid chromatography, gas chromatography, spectrophotometry, Hunterlab Colorimeter, and Instron texture measurement.

Conducted pilot scale processing trials involving grinding, mixing, drying, smoking, cooling/freezing, packaging, frying and thermal processing.

November, 1987 to April, 1988

Food Scientist, Process and Environmental Engineering Group
WARDROP ENGINEERING INC., Winnipeg, MB

Planned, organized and conducted laboratory studies for a two-stage conversion of lactose to lactic acid using immobilized bacteria.

Evaluated immobilization media for lactic acid bacteria.

Sourced new equipment and processing methods for a vegetable processing plant.

Summer, 1983 **Product Development Specialist**
STOW SEED PROCESSORS LIMITED, Graysville, MB

Product development of an all grain granola mix, multi-grain bread and masa harina.

Conducted a market study on the products.

Summer, 1982 **Research Assistant, Process Development**
CANADIAN FOOD PRODUCTS DEVELOPMENT CENTRE
Portage la Prairie, MB

Product and process development of fish and red meat food products.

Summer, 1981 **Research Assistant, Food Microbiology**
CANADIAN FOOD PRODUCTS DEVELOPMENT CENTRE
Portage la Prairie, MB

Performed microbiological testing on a variety of dairy, grain and meat products.

EDUCATION

1987 Master of Science, University of Manitoba, Department of Food Science (Food Chemistry) Thesis Title: Anthocyanins of the Saskatoon Berry: Interaction with physical and chemical parameters and colour intensification of the pigment extracts.

1984 Bachelor of Science in Agriculture, University of Manitoba (Major in Food Microbiology)

PERTINENT INFORMATION

Instructed University laboratory courses in Advanced Food Microbiology and Chemical Analysis of Food. Delivered presentations for professional development short courses on 1) Margarine Ingredients and Processing and 2) Sanitary Processing and Microbiological Hazards in Grain Based Products.

Short Courses Attended

- Managing Multiple Projects. Skillpath Seminars, Saskatoon, 1993.
- Design of Experiments/Accelerating Product Development by Microcomputer. American Association of Cereal Chemists, St. Paul, MN, 1992.
- Economic Statistical Process Control by Microcomputer. American Association of Cereal Chemists. St. Paul, MN, 1992.
- Industrial Drying Technology. Center for Professional Advancement, Sommerset, NJ, 1990.
- Research Management. University of Guelph extension services, Saskatoon, 1989.
- Food Texture Measurement. Ontario Technology Centre, Mississauga, ON, 1988.
- Modified Atmosphere Packaging. Ontario Technology Centre, Mississuaga, ON, 1988.

PROFESSIONAL AFFILIATIONS & COMMITTEES

- Institute of Food Technologists
- Member of Steering Committee for a Nutraceutical/Functional Food Centre of Excellence, Alberta, 1997
- Member of Advisory Sub-Committee on Funding for Food Science and Technology for Saskatchewan, 1992 - 1994
- Canadian Institute of Food Science and Technology
  Executive positions held: Membership Chair, Saskatchewan section, 1990/91
  Secretary/Treasurer, Saskatchewan section, 1991/92

PUBLICATIONS & PATENTS

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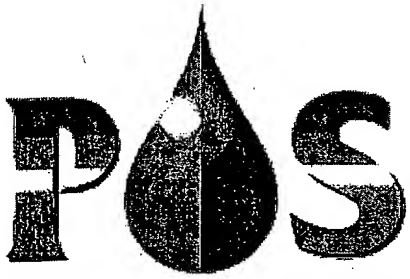

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Our experienced and professional staff and premier facility combine to give the tools you need in the highly competitive nutraceutical, dietary supplement, and functional food industries. Join the ranks of other successful organizations making nutraceuticals our largest area of business activity.

Knowledge and Experience

Gone are the days when anyone could produce a market acceptable nutraceutical or dietary supplement. Today successful natural products require the know-how **POS** can provide:

- Process and product development
- Product standardization
- Analytical methodology development
- Process scale-up
- Ingredient sourcing
- Shelf life testing
- Regulatory compliance
- HACCP protocols and GMP plans
- Antioxidant evaluation
- Process and product optimization
- Consulting

Total Capability Under One Roof

- Product development from grams to tons matching every stage of your business
- Use any or all of our 5 large and versatile processing areas
- Diverse solvent extraction capabilities with many different solvents and raw materials
- 10 fully equipped laboratories for bench scale product development or complete product analysis
- 24 hour-a-day operating schedule for continuous processing of your materials
- Analytical services integrated into each processing step

- Complete quality support including: cGMP, HACCP, CFIA and HPB compliance*
- Strict confidentiality protocols
- Comprehensive process documentation

**Current Good Manufacturing Practice; Hazard Analysis and Critical Control Point; Canadian Food Inspection Agency; Health Protection Branch*

Access Unique Processing Equipment

POS will lead you from concept to bench scale testing to pilot scale development and finally to market production—all in one facility. Our equipment list is especially suited to nutraceutical, dietary supplement, and functional food products.

Milling & Mixing Equipment

- **Mills** - Hammer, pin, flaking, cracking, disc, Szego, colloid, comminuting, dehullers
- **Mixers** - Wet and dry mixers including Hobart mixer/dicer, ribbon, twin shell blender, homogenizers

Extraction Equipment (solvent and/or aqueous)

- **Extractors**: Crown, Soxhlet, Heinkel inverting basket centrifuge
- **Desolventization**: Various units for solids and liquid desolventization

Drying and Evaporating Equipment

- **Dryers**: Spray, vacuum tray, fluidized bed, convection, drum, ring, tunnel and freeze
- **Evaporators**: Flash, thin film, scraped surface, rising film

Separation Equipment

- **Chromatography**: CPC (centrifugal partitioning chromatograph), pilot scale HPLC
- **Filtration**: Plate and frame, cartridge, ultrafiltration units
- **Air classifiers**: Centrifugal and gravity
- **Centrifuges**: Decanter, desludger, solid bowl, basket, inverting basket, nozzle bowl

Other Equipment

- Littleford reactor/dryer
- oilseed crushing and complete oils processing line
- pasteurization

This is just a partial list and we regularly acquire new equipment that is suitable for the nutraceutical, dietary supplement, and functional food industries. For more complete information on these resources, please contact us. We can arrange a free consultation to

discuss your needs. POS will evaluate your objectives and customize a program suited to your individual requirements. Of course, all matters are completely confidential.

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Site Administration: webmaster@pos.ca

Fats, Oils and Lipids Our Specialty

Our Capabilities = Your Success

POS Pilot Plant helps you put high quality products into the marketplace faster using cost effective methods. We achieve this by augmenting your resources with our experienced staff and our full range of product development options. Our fats, oils & lipids capability covers oilseed crushing, solvent extraction and oil processing. Quantities range from gram to multi tons serving your needs at every stage of the development process.

You want your new products to be market ready and you want to benefit from first to market advantages. **POS** is ready and poised to help you achieve these objectives.

Services That Make a Difference

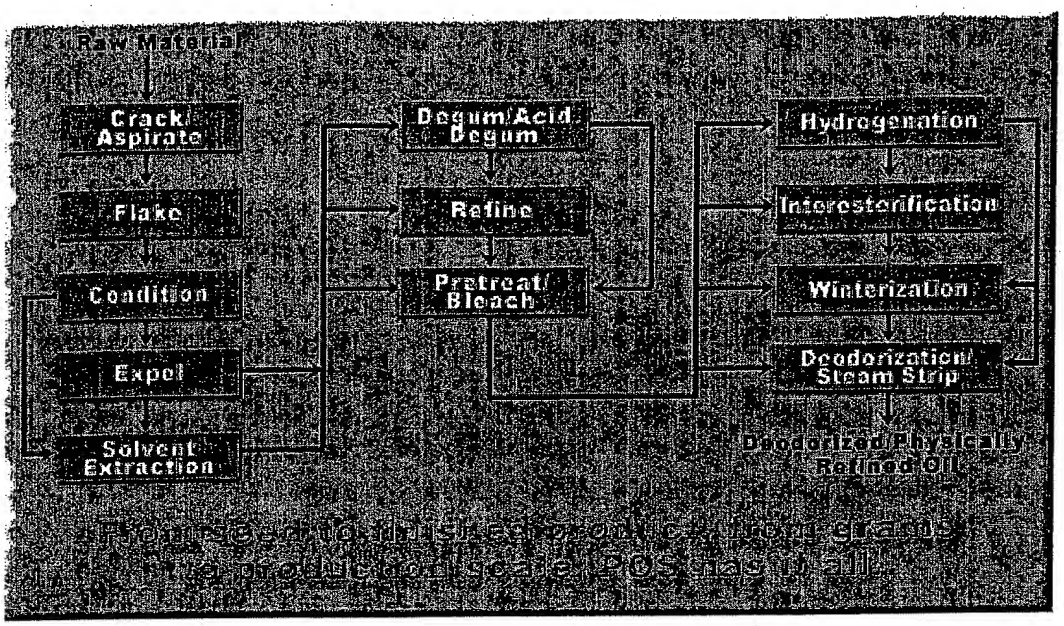
POS's services are designed to provide maximum benefit to our clients, including:

- Staff with years of industrial experience to augment your capabilities
- Strict confidentiality protocols to protect your investment and technology
- Product and process development
- Scale up from grams to tons all in one facility
- Complete range of integrated analyses for fats, oils, lipids, oilseeds and related by products
- Consulting services to solve problems in the field
- Optimization of products and processes
- Quality systems for cGMP, HACCP, CFIA and HPB compliance*
- Scientific depth to develop solutions for by-products and waste streams.

**Current Good Manufacturing Practice; Hazard Analysis and Critical Control Point; Canadian Food Inspection Agency; Health Protection Branch*

A Facility Designed to Match Your Need

- Large flammable processing area for solvent extraction of oilseeds and fat bearing materials and hydrogenation of fats and oils
- Primary processing area for seed cleaning, seed preparation and pressing
- Comprehensive oils processing area for every oil processing unit operation
- Flexible secondary processing area for processing by products
- 10 fully equipped laboratories for mini scale product development and product analysis
- 24 hour-a-day operating schedule for continuous processing and quick turn around
- Comprehensive process documentation.



Processing Equipment

Seed Preparation and Crushing

- **Mills** - hammer, pin, flaking, cracking, disc, Szego, colloid
- **Cleaning** - multi deck, specific gravity table, grain dryer, indent cylinder, aspirator
- Simon Rosedowns cooker prepress/full press, bench press

Solvent Extraction Equipment

- Bench & pilot scale Crown solvent extractors
- Heinkel inverting basket centrifuge for powders
- Soxhlet extractors (various sizes)

Refining Equipment

- **Centrifuges:** Alfa Laval S-194, Westfalia SA-7 and SA-14, bench scale CentriPeel.
- **Reactors & Filters:** Various sizes from bench scale to 2,600 L for bleaching, interesterification and hydrogenation.
- **Deodorizers:** Glass and stainless steel bench scale, 250 kg/hr continuous, 400 L batch.
- Winterization vessels for solvent and non-solvent from bench scale to 4,000 L, dry fractionation

Other Equipment

- CPC unit (centrifugal partitioning chromatograph) and pilot scale HPLC for ultra pure lipids
- Thin film, scraped surface, rotary evaporators

POS continually updates its equipment. Please contact us about specific capabilities.

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Food & Ingredients Formula for Success

Printable Page

Your Product Development Partner

With today's volatile markets and short product life spans, companies are finding it more challenging to stay competitive. Outsourcing product development activities is becoming increasingly popular as a viable strategy for getting market ready products to the consumer in record breaking time.

As your product development partner, **POS** provides services you need:

- Strict confidentiality protocols
- Project management systems for superior results and rapid market entry
- Experienced staff to complement your technical and operational capabilities
- Full line of product development capabilities from bench scale to production

At **POS**, we create long term, value added relationships with our clients to enhance their new product development capabilities.

Service Offering

POS focuses on developing new products and ingredients to meet specific market niches. Areas of expertise include:

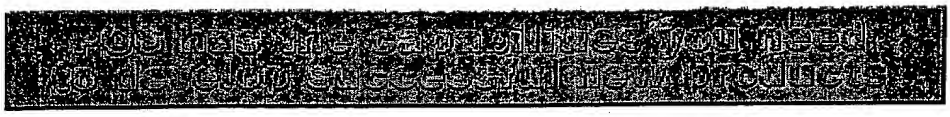
- Ingredient selection and compatibility testing
- Product formulations and modifications
- Product and process development and optimization
- Formulation and cost optimization
- Experimental design and statistical analysis
- Product standardization
- Analytical methodology development
- HACCP protocols and GMP plans

The Facility to Match Your Every Need

- Five large GMP compliant processing areas
- Scalability ranging from grams to tons to suit every stage of development
- Unmatched process documentation and sampling protocols
- Solvent extraction for many different solvents and raw materials
- Processes coordinated with in-house analytical support for rapid results
- Confidentiality systems to protect your intellectual capital
- Ten laboratories for bench scale product development and product analysis
- Pilot plant on a regular 24 hour-a-day operating schedule for realistic process simulation and production

- Comprehensive quality support including: cGMP, HACCP, CFIA and HPB compliance*

*Current Good Manufacturing Practice; Hazard Analysis and Critical Control Point; Canadian Food Inspection Agency; Health Protection Branch



Processing Operations

POS offers a range of equipment options unavailable anywhere else:

Extraction (solvent or aqueous)

- **Extractors:** Heinkel inverting basket centrifuge, bench & pilot scale Crown solvent extractors, Soxhlet extractors of various sizes
- **Desolventizers** for solids and liquids: De Laval scraped surface evaporator, rising film evaporator, Littleford vacuum mixer dryer, down draft desolventizer
- **Dryers:** Spray, vacuum tray, fluidized bed, convection, drum, ring, tunnel and freeze dryer
- **Mills:** hammer, pin, flaking, cracking, disc, Szego, colloid, Fitzpatrick

Fractionation

- **Centrifuges:** Alfa Laval S-194, Westfalia SA-7 and SA-14, bench scale CentriPeel
- **Filters and screens:** Plate and frame filters, pressure leaf filters, stainless steel screens
- **Winterization:** Vessels for solvent and non-solvent from bench scale to 4,000 L
- **Edible oil deodorizers:** Glass and stainless steel bench scale, 250 kg/hr continuous, 400 L batch

Purification

- **Chromatography:** CPC unit (centrifugal partitioning chromatograph) and pilot scale HPLC for ultra pure natural compounds
- Ultrafiltration (various module types available)

Modification (enzyme and chemical)

Reactors: Various sizes from bench scale to 2,600 L, full vacuum, pressure, high temperature

POS continually updates its equipment. Please contact us with specific requests.

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October 8, 2002

To whom it may concern:

As an educated nutritionist, scientist, clinician and sole inventor of the skin lotion technology, my applying science to the development of a cosmetic and therapeutic skin care product led to the contracting of the POS Pilot Plant Corporation.

On January 28, 1998, I signed a Confidentiality Agreement with POS, followed by a Contract For Service on May 21, 1998 to further develop the skin care lotion in the areas of processing and scaling-up production.

On March 31, 1998, the contractor called me regarding his first experience with the skin lotion application following a day's work in the laboratory. The contractor was amazed that the application to the hands had resulted in skin qualities such as smoothness, shine and resilience. I was not surprised because of the on-going results seen with my patients and that of therapists in the field. (See attached letters comparing the skin lotion prepared with magnetized water known as regular lotion to the skin lotion prepared with deionized water known as placebo lotion.)

On May 15, 1998, I discussed the source of water for the project with the contractor. I expressed concern on the use of deionized water. However, the contractor argued with me that POS always used deionized water for R & D projects and was told not to worry as the contractor expected the same product results with either the deionized water or the magnetized water.

In mid-summer 1998, POS produced batches of both the skin lotion (oatstraw steeped in deionized water with the added compounds of vegetable glycerine and lavender oil) and the skin lotion (oatstraw steeped in magnetized water with the added compounds of vegetable glycerine and lavender oil). These samples were then assessed by both the contractor and myself.

Differences in smell, application, absorption and skin feel were immediately noticeable upon examination of the above samples when comparing the samples prepared with the magnetized water and the samples prepared with the deionized water. The samples prepared with deionized water had an offensive corn-like odour, an absence of a clean sharp scent of lavender, and when applied to the skin, the lotion was difficult to spread and slow to penetrate into the skin and left the skin sticky to the touch as compared to the samples prepared with magnetized water having a clean distinctive scent of lavender, and when applied to the skin, the lotion smoothed over readily and was quick to absorb into the skin and left the skin smooth and silky to the touch.

In late July, 1998, to comprehend and to define the differences between the two samples, POS performed pH and conductivity tests on my magnetized water and the contractor's deionized water. The contractor advised me of the pH readings as being lower for deionized water and higher for magnetized water. Furthermore, there was a striking difference distinguishing the conductivity readings between the deionized water and the magnetized water, with the magnetized water being considerably higher.

The contractor discovered that the application and the absorption of the skin lotion was definitely more effective when the lotion was prepared with magnetized water as compared to the deionized water. This proved to be in keeping with the contractor's previous remarks of March 31, 1998, mentioned earlier in this letter.

Hence, the contractor counted on substituting deionized water for magnetized water without modifying my product. As presented above, the contractor was astonished on how the feel, chemical properties and effectiveness of the end product had been influenced by this substitution.

Based on my recollection,I make this solemn declaration conscientiously believing it to be true and knowing it is of the same force and effect as if made under oath.

Sincerely,

Lorraine Mignault

Lorraine Mignault
Inventor

ATTORNEY DOCKET NO: 82223-202

EXAMINER	Shengjun Wang
ART GROUP	1617
APPLICANT	Lorraine Mignault
SERIAL NO:	09/762,232
FILED	August 4, 1999
FOR	Topical Lotion Containing Oatstraw

Commissioner of Patents
Washington, D.C., 20231
U.S.A.

Dear Sir:

AFFIDAVIT

I, Lorraine Mignault, of Suite 3209-197C Victor Lewis Drive, Winnipeg, Manitoba, Canada solemnly declare that:

1. I am the sole inventor of USSN 09/762,232, filed August 4, 1999 and entitled "Topical Lotion Containing Oatstraw".

2. My invention is an oatstraw extract prepared by magnetically treating water, steeping oatstraw in heated magnetically treated water, and filtering the extract to remove oatstraw particles, thereby producing an oatstraw extract which can be applied to the skin as a topical lotion or used as an additive or carrier for other products. The combination of the oatstraw extract in magnetically treated water has several surprising properties, including improved rate and depth of absorption when applied on the skin, as discussed in the affidavits executed by myself on October 8, 2002 and by Mr. Rick Green of POS on October 1, 2002 that were submitted for the examiner's consideration earlier.

3. Regarding the Weed reference, this reference teaches pouring boiling water onto dried oatstraw and then adding that "oats and all" to a larger quantity of water, such as to water in a bathtub or footbath.

4. My invention differs from Weed's teachings in several important ways:

(i) Weed does not teach or suggest the use of magnetically treated water but rather clearly teaches the use of tap water;

(ii) Weed does not teach filtering to remove the oatstraw particles, meaning that Weed does not teach an oatstraw extract but rather Weed teaches only an oatstraw bath; and

(iii) Weed does not teach using the oatstraw extract as a lotion, as an additive or as a carrier for other products.

5. In spring 2003, I followed the teachings of Weed. Specifically, I added boiling water to dried oatstraw that had been chopped and then added that to a bathtub filled with warm water. What I found was that the chopped oatstraw stuck to my body and had to be physically removed or picked off. Furthermore, the free oatstraw clumps had to be scooped out of the bathtub during the draining process to prevent clogging of the drain. In addition, the water in the bathtub left a sticky residue on the body which could not be removed simply by wiping or drying with a towel and in fact required subsequent rinsing under a showerhead to remove the residue. That is, this residual stickiness in the bathwater was independent and separate from the oatstraw clumps. Similar results would be obtained using the teachings of Weed for any body part, for example, in a footbath. That is, the clumps of wet oatstraw adhere to the body, including the feet and must be physically removed and the water in the bath leaves a sticky residue on the body parts exposed thereto, which is separate and independent from the oatstraw clumps.

6. My experiences following Weed led me to conclude that anyone following Weed would find the experience time-consuming, frustrating and in fact irritating to the skin due to the added effort necessary to remove the oatstraw clumps and residue, as discussed above. Given the difficulties associated with the removal of the oatstraw clumps and associated residue from my body as well as from the inner surfaces of the bathtub or waterbath, I can only conclude that when Weed states "oats and all" she is saying to the reader "I know the oatstraw is messy, but it is necessary". This teaches that the oatstraw clumps are needed in the water and teaches against filtering.

7. Magnetization or magnetic treatment of water is believed to improve the ability of the water to "hold" other compounds. That is, magnetically treating water improves the solubility of water so that higher concentrations of compounds or solutes can be held in solution. In my invention, the magnetic treatment or magnetization of the water results in more of the oatstraw extract remaining in solution and also eliminates the sticky residue associated with oatstraw baths. The combination of the oatstraw extract in magnetically treated

water also has improved application and absorption characteristics compared to extracts prepared in deionized water as described in my previous affidavit and as supported by the affidavit filed by Mr. Rick Green.

8. The examiner's comments regarding the requirement for minerals in the magnetically treated water and that the use of magnetically treated water would be obvious to anyone wanting "cleaner" water are not understood.

Specifically, regarding the presence of minerals in magnetically treated water, it is noted that as discussed above, minerals may be more readily dissolved in magnetically treated water as may any water-soluble compound added to magnetically treated water. However, the magnetization process is believed to act on the water molecules themselves and not only on minerals or other compounds in the water. As such, the specific mineral content of water prior to treatment is not critical to the magnetization process. Following magnetization, the water will be able to "hold" more solutes than prior to treatment, regardless of the mineral content of the water. Furthermore, I believe that steeping oatstraw in any magnetically treated water, regardless of mineral content thereof, would have improved spreading and absorption properties, including enhanced smoothness, softness and moisturization compared to an oatstraw extract prepared in the same water without magnetization.

Regarding "cleaner" water, it is noted that magnetically treating water as taught by Ito might result in "clearer" water in that more sediment would be dissolved in the Ito-treated water compared to untreated water, but it is not clear that that makes that water "cleaner".

It is also noted that the examiner has previously implied that the benefits of magnetically treating water were controversial at best but has now taken the position that the use of magnetically treated water would be obvious.

Regarding this point, it is again noted that Mr. Rick Green of POS also believed that the type of water used would not make a difference in my invention and prepared samples of oatstraw steeped in deionized water. As discussed in my earlier affidavit and in his affidavit, the differences in the properties of the extract were readily apparent. Specifically, the extract prepared in deionized water did not spread as easily and was not as readily absorbed among other differences discussed in greater detail in the earlier affidavits.

Oatstraw extracts have also been prepared in tap water, and similar results were observed as with the deionized water. That is, greater effort was

required to spread the extract onto the skin, and the extract was not as readily or as quickly absorbed. Furthermore, the tapwater extract also left a residual stickiness.

It is noted that Weed teaches the use of tap water and that deionized water is the standard used in industrial applications. Oatstraw extracts made using tap water or deionized water both had less desirable characteristics compared to the oatstraw extract prepared with the magnetized or magnetically treated water. Deionized water is considered to be cleaner water than tap water and as discussed above is the "industry standard" and yet the extract prepared in the deionized water did not have the same properties of absorption and "feel" as the extract prepared in magnetically-treated water.

9. The combination of the oatstraw extract prepared in magnetically treated water has improved ability to retain nutrients from the oatstraw, spreads more readily when applied to the skin, absorbs more quickly and deeply, has enhanced smoothness, softness and moisturization and lacks the sticky residue associated with the extract when prepared with non-magnetically treated water, whether tap water or deionized water. These results are surprising as evidenced by the fact that Mr. Green believed that deionized water would be the same as magnetized or magnetically treated water in my invention. As discussed above, that was found not to be the case.

10. The fact that there was no residual tackiness led to my realization that the oatstraw extract in magnetically treated water could also be used as a carrier or additive with other products because benefits from the oatstraw extract were long-lasting and independent of the presence of the oatstraw clumps and the use of the magnetically treated water removed residual "stickiness" or tackiness from the extract. Presence of oatstraw clumps or sticky residue would have led to clumping or precipitation or other problems when the extract was added to other compounds.

11. In summary, as discussed above, my invention differs from Weed's teachings in several important ways:

(i) Weed does not teach or suggest the use of magnetically treated water but rather clearly teaches the use of tap water. As discussed above, the use of magnetically treated water results in an oatstraw extract that has improved properties compared to an extract prepared in tap water, such as improved rate and depth of absorption and no residual stickiness.

(ii) Weed does not teach filtering to remove the oatstraw particles, meaning that Weed does not teach an oatstraw extract but rather Weed teaches only an oatstraw bath. As discussed above, Weed teaches that the bath must contain "oats and all". The problems and limitations with this approach are discussed above.

(iii) Weed does not teach using the oatstraw extract as a lotion, as an additive or as a carrier for other products. That is, the oatstraw particles taught by Weed would clump and be unsuitable for use in combination with other products. Furthermore, even simply filtering to produce an extract (which Weed does not teach or suggest) would still produce an extract with residue problems as discussed above which could cause clumping or precipitation of other components of the mixture.

12. Thus, it was my discovery that the combination of an oatstraw extract in magnetically treated water retained the positive benefits of an oatstraw bath without the drawbacks of the oatstraw bath (discussed above) and had improved properties of absorption and "feel" (discussed above) that led me to realize that in addition to use as a body lotion (not taught by Weed), the oatstraw extract could also be used as a carrier or additive with other compounds.

13. I declare that all statements made therein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the instant patent application or any patent issuing therefrom.

SWORN before me at, WINNIPEG, MANITOBA)
)
, this 11TH day)
)
of JANUARY, 2005 .)

.....
A NOTARY PUBLIC IN AND FOR
THE PROVINCE OF MANITOBA

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Lawrence Wigmore

First Hit

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L12: Entry 13 of 21 File: DWPI Jul 27, 1997

DERWENT-ACC-NO: 1998-143751
DERWENT-WEEK: 199813

TITLE: Preparation of ecologically clean magnetised water - includes cooling with aeration and input of additives, flocculation of ferromagnetic admixtures, settling, filtration and magnetic field action

INVENTOR: PATRASENKO, V S; SHEVTSOV, N G

PATENT-ASSIGNEE:

ASSIGNEE	CODE
PATRASENKO V S	PATRI

PRIORITY-DATA: 1994RU-0028820 (August 1, 1994)

Search Selected Search ALL Clear

PATENT-FAMILY:

	PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
☐	RU 2085296 C1	July 27, 1997		003	B03C001/005

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
RU 2085296C1	August 1, 1994	1994RU-0028820	

INT-CL (IPC): B03 C 1/005

ABSTRACTED-PUB-NO: RU 2085296C
BASIC-ABSTRACT:

Water in flow through pipes in system with magnetic devices with velocity at least 0.9 m/minute comes under action of magnetic field of induction 20-80 mT at the centre of working spacings perpendicular to flow. The magnetic field is generated by a magnetic laid-on device containing at least 3 pairs of magnets assembled in block at mutual angles at most 90 deg. . The cooling of water is to 15 deg. C with aeration and input of taste-improving additives. The settling and flocculation is carried out in the course of 2 minutes in the same apparatus. The filtration is for the removal of iron oxides, nitrates, heavy metals, residual chlorine and organic compounds. The magnetic treatment is carried out prior to settling and filtration, prior to cooling, and prior to bottling of aerated water containing additives.

USE - The method is used for preparation of ecologically clean drinking water which can be used in household cooking and food-processing industry.

ADVANTAGE - The prepared water corresponds to quality standards of drinking water and has curative-prophylactic properties, due to higher activity of oxygen and other gases dissolved in water.

CHOSEN-DRAWING: Dwg.2/2

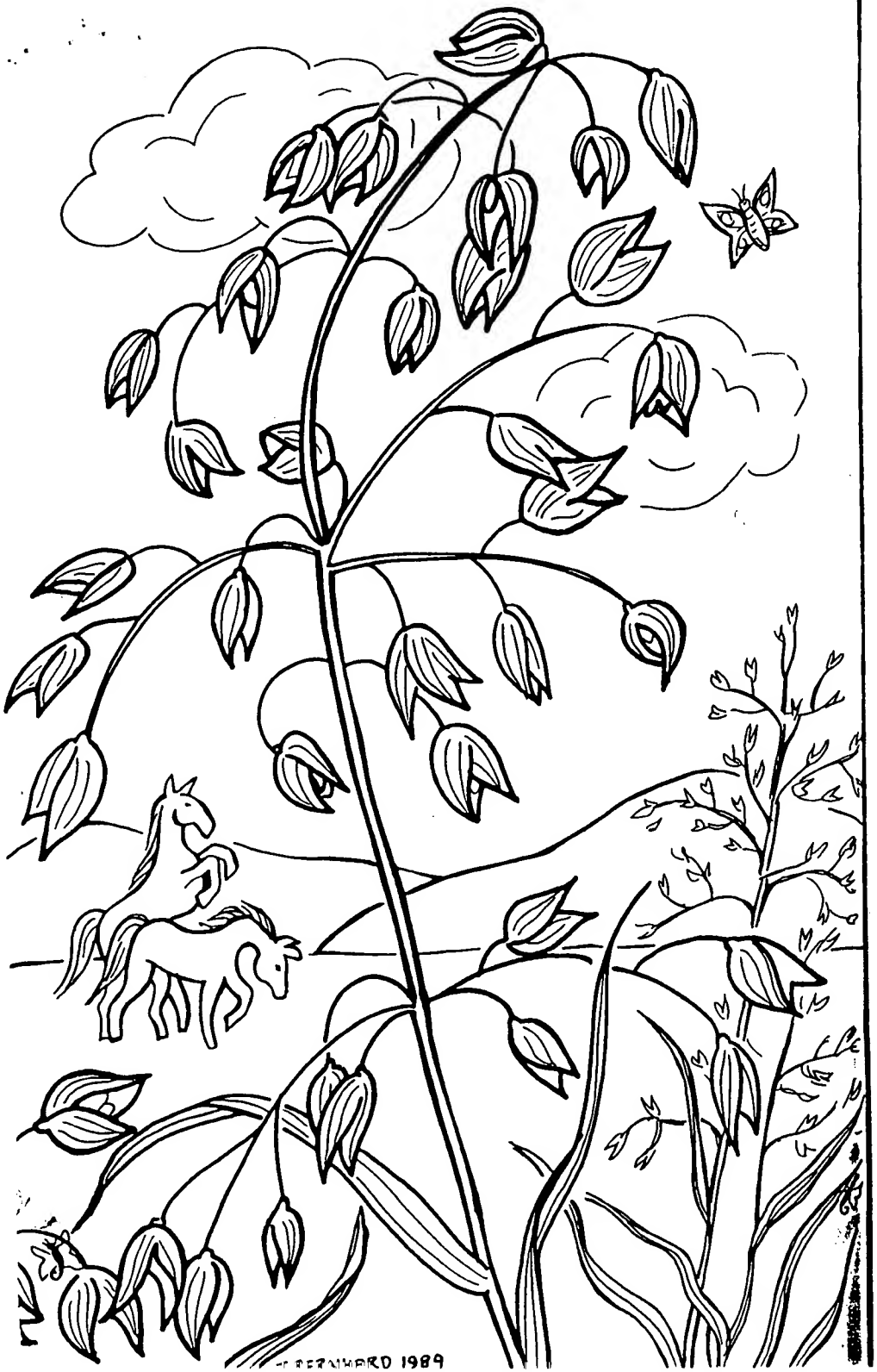
TITLE-TERMS: PREPARATION ECOLOGICAL CLEAN MAGNETISE WATER COOLING AERATE INPUT ADDITIVE FLOCCULATE FERROMAGNETIC ADMIXED SETTLE FILTER MAGNETIC FIELD ACTION

DERWENT-CLASS: D15 P41

CPI-CODES: D04-A01B; D04-A01F; D04-A01K; D04-A01Q; D04-B; D04-C;

UNLINKED-DERWENT-REGISTRY-NUMBERS: 1508U; 1740P ; 1781U

SECONDARY-ACC-NO:
CPI Secondary Accession Numbers: C1998-046895
Non-CPI Secondary Accession Numbers: N1998-113708



Oatstraw Speaks

Feeling your oats today? Whoa! Now do mind your manners. Don't stop . . . just be . . . discreet . . . I do love the way you stroke my blades and touch my kernels. My grain's milky ripeness is pleasing, is it not? Come and move with me. Let your heart ripple with me. Let your imagination soar with me a while, while the wind lifts my long green leaves, like feathers, flying.

My name is Oats. I am priestess of Ceres, great mother of grain. Yes, yes, do touch me there.

I am the archetype of fertility. I am the image of optimum nourishment. I am Corn Mother. I am the mother of many, many breasts. Welcome warm womb am I; seed filled with life am I; born of heaven and earth am I, I who nurture all. Yes, do suck there. Ummmm.

Those with four legs graze my green grass. Ummmm. The creeping, crawling ones find shelter and sustenance among my hollow stalks. Ohhh, that does feel so pleasant; do continue. The feathered flying ones, and you, the ones with hands, relish my seeds. My seed, my sweet grain, the milk of the earth's breast, is your first food after your own mother's milk.

You look so beautiful there in the dapple of my shade. Come, be more bold upon me. Imbibe me. Grasp me and harvest my sweet, short life to feed your own. Drink deeply of me. Take me into you. Open yourself to me. Do not hesitate. The fullness and richness of life is yours.

I know you see me as a simple woman, a country woman, with little wisdom, a woman easily taken. Yes, do lie down here with me. This ignorance is fortunately recent. In ages past, I was known as goddess. Further back, I was honored with art, dance, poetry, and love. Yes, yes, love. Do come lie down with me here in the hay.

I am the mother's gift of nourishment. I am the mother's gift of love. Love. Love! I am love in form. Love from your mother, my great granny Gaia. I bring contentment. I bring rich, full nourishment for spirit, hearth, community, earth wherever I am grown with honor, joy, and love.

It is true that I am young, and that my roots are shallow. Compared to yonder oak, I am of less note than the passing butterfly. But I carry, conscious, the memory of all my sisters: sisters of the sacred cycle. And so I know more than my youth suggests.

Yes, I am wise and sweet, far wiser yet and richer sweet than you may guess. We grasses have seen, year after year, the great play of life here on this sweet, green earth, we grasses who are the great green heart of the mother earth. I am life. Learn how to nourish yourself with me and you will find yourself steady, vital, sensitive, strong, at one with the mother of all.

I have grown here under stars, moon, and sun, and have concentrated the lights of heaven into myself. I have investigated the earth for minerals. I have found stability in storms and the mother's love. I have concentrated the power and subtlety of many transformations into my being.

Now, you eat me. All this comes to you, through me. You are gifted by the Goddess, whose priestess I am.

Fertility priestess. Your books say: "temple whore." Yes, do rub a little harder there. Ummmm. Come a little closer. Watch the graceful curve of my neck. Flare your nostrils and catch my enticing, soft, secure scent.

Breathe deeply; breathe evenly; be aware of your breath. Be aware of the stallion. Remember the stallion covering the mare. Remember the gleam of his dappled coat, here in the dappled shade as you breathe deeply, and fully, and remember.

Yes, remember.

Remember the stallion covering the mare: the fierce brightness of his eyes, the lightning energy of his moving muscles. Remember the stallion grazing here, eating me, becoming filled with me.

Breathe slowly, remember. I am the gleam in his dappled coat, shining bright. I am the gleam in his fierce eye, looking keen. I am the gleam of his muscles, lightning energy. Remember, remember me.

Remember.

I remember. She made me promise not to tell, but that was so long ago. Thousands of years ago. Thousands of years ago when it was the hot gossip. She swore me to secrecy then, but that was so long ago. Who cares now? Who even remembers ? Who wonders what really went on between Poseidon and my mother Demeter?

You want to know? Yes, let me brush your cheek here; I'll tell you. Though Demeter didn't tell me. We are close, very close for mother and daughter, but she would have us all believe the official stories, me included.

No, Mother never discussed with me her relationship with my father. "That is over and done with," she would tell me when I asked. But my great granny Gaia was kind of sweet on my dad, if you ask me. Yes, do turn this way. Anyway, Gaia made sure I got the real story. Well, the real story according to her.

It wasn't just a matter of Poseidon lusting after my mother, Gaia told me. Gaia said Demeter was just as avid for him as he was for her. But she wouldn't let on! I mean, even though she is a fertility goddess and all, mother is really stern and severe. She always leaves the erotic, sensual parts for Aphrodite.

No, it would not do at all, my mother must have thought, to consort with her own brother, Poseidon. Not at all. Nor, especially, to let on to anyone (except granny Gaia) how she lusted after his salty tang.

So, hoping to forget her eagerness for Poseidon's treasure, Demeter threw herself into her work. Early one misty morning, under granny Gaia's guidance, she shape-shifted. She shape-shifted into a roan mare.

As mare, Demeter lifted her head, breathed deeply, and quivered in ecstatic communion with the vital essences of grass, earth, sun, and wind. And riding that bliss was the image of Poseidon. The repressed, denied longing to merge with her brother came to her full force on the morning breeze. (Did she really tell great-granny this? Did she really share her desire? Or did Gaia just sense what must have happened?)

Her primal heat awoke and spread. Her skin felt boundless and deep; her eyes closed as sparks flared through her nerves. And in that instant, Poseidon appeared.

Poseidon appeared as a dappled stallion. Dappled stallion he, he knew the way was clear for him now. As mare, Demeter would receive him; she could not, as mare, deny her ardent wish to enfold him, to pull him into her, to fill herself bursting full of him. This wish, this truth, she could deny in human form. As mare, Demeter could not deny. She could only act the truth.

Great-granny Gaia never really told me what happened then. I mean, not the details! By the time I was born, he was back at sea, and nobody was the wiser, so far as Demeter was concerned. I loved the seaweed he would send from time to time. But no one would talk about my father. Remember, it's a secret.

But to get on with the story, I was born. And so was my dumb brother, Arion. Well, he isn't really dumb. In fact, he's very gifted. I mean he can actually speak. And that's really something for a horse, don't you think? A talking horse. Ha, ha. A talking horse for a brother.

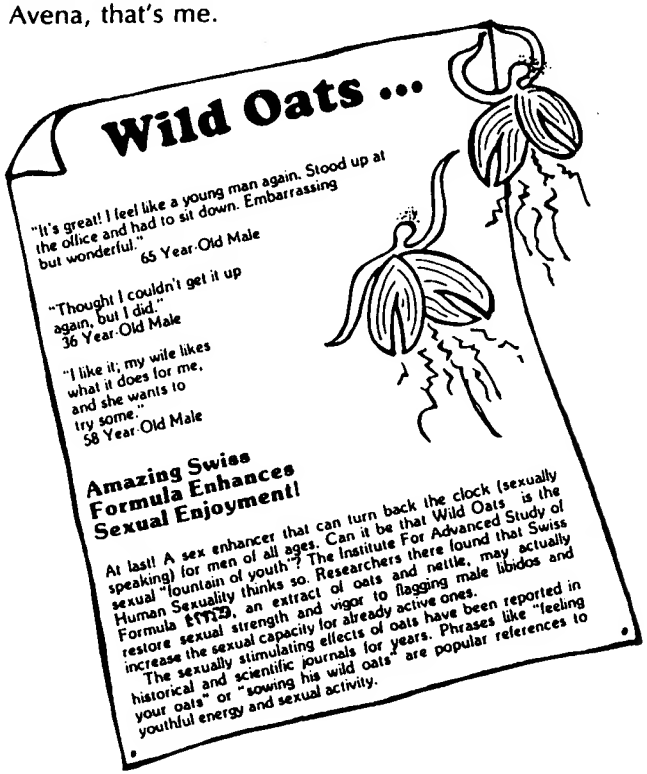
Yes, we were both embarrassments to Demeter, I'm afraid. You can hardly hide the results of your lust, even if you're intent on making everyone believe you're demure. Not that anybody in Olympus ever cares if your lover is your brother or mother or whatever. But we did have a way of reminding her of a secret she would rather forget.

Arion's horse shape spoke to her every day of her inability to deny her desire, her primal heat. And you can bet she resented him for that. And maybe his gift of speech made it even worse for her. (Personally, I always wanted him to shut up.) And as for me . . .

As for me, well you know me now. I take after mother, and great-grandmother, too. I'm tall and slim, graceful, and hauntingly beautiful. I'm blond and breezy and ready for you. Demeter tried to hide me; and great-granny Gaia said I shouldn't tell my name to mortals. But I don't think anything will happen if I tell you my story and tell you my name.

I am Avena: daughter of earth and ocean pulsing together. I am Avena, nourished by mare's milk, brought up as human. Avena, avena, will you whisper it with me? Avena, avena, like silk skirts whispering in a breeze. Avena, avena.

Avena, that's me.



Oatstraw Facts

Botanical name: *Avena sativa*; avena (Latin) means oats; sativa (Latin) means cultivated. ***Other useful species:*** *A. fatua, A. barbara* are wild oat species; *A. orientalis, A. nuda*, and *A. stringose* are modern cultivars. ***Natural order:*** Graminaceae/ Grain family. ***English names:*** Oats, groats, wild oats, naked oats, tartarian oats, bristle-pointed oats. ***Chinese names:*** Yen-mai. ***French names:*** Avoine cultivée. ***German names:*** Hafer, Saathafer, Gruen Hafer. ***Russian names:*** Oves. ***Welch names:*** Ceirch llwyd, blewgeirch. ***Fiber uses:*** Husks are used to stuff bedding. ***Food uses:*** Rolled oats, steel-cut oats, and whole oats are readily available as people/animal feed; production world-wide for 1988 was 55 million metric tons. ***Medicinal uses:*** Still recommended by MDs for acute itchy dermatitis, like chicken pox. ***Soil uses:*** Helps prevent erosion, especially on marginal (acidic, depleted) soils. ***Animal uses:*** Oat hay and oats are important foodstuffs; widely used for horses. ***Habitat:*** Cultivated land, banksides, grainfields. ***Natural range:*** Mediterranean, Near East. ***Current range:*** Cultivated and growing as a weed on all the great plains of the world, especially China, Europe, North America, Australia, New Zealand, Asia, and South Africa. ***Toxicity:*** Unhazardous internally and externally; wind-blown pollen is allergen. ***Best identified by:*** Hanging, swaying seed heads; large milky grain; the sigh the wind makes in her hair.

"It is the oats which grow so quickly after rains have come. It is the wild oats which ripen so rapidly. Their graceful open tassels shake in the wind . . . glisten in the sun . . . give the coastal breezes their distinctive sound . . . a rustle as of stiff silk petticoats. . . ." E. Anderson (1969)

Oatstraw Weed Walk

What a mellow September day, full of slanting sun and grasshopper wings in gaudy colors. We could be walking in an ancient grainfield in Mesopotamia as easily as here in the closing years of the twentieth century.

This field of oats is eternal, is it not? The blue sky doesn't have a date. The mouse scurrying there doesn't belong to any particular century. Who can say if the wind is old or young?

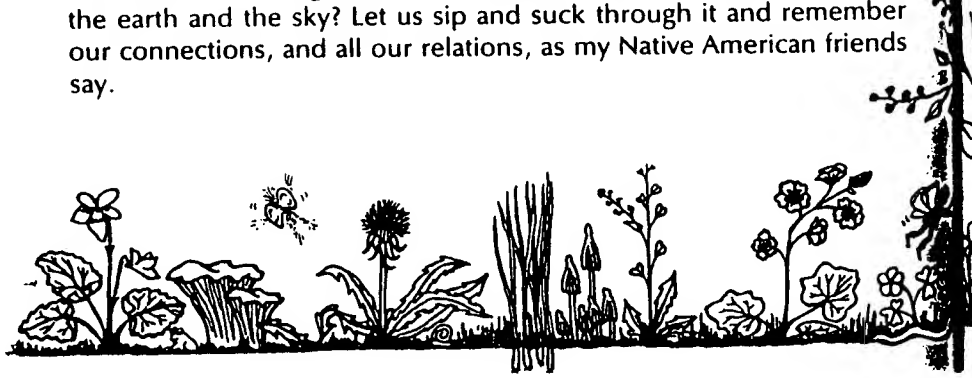
Does it make you feel peacefully free to see the oats rippling under the wind's caress? Does it ripple in your eyes and your mind and set you free? Free for even a short while of the constraints of your own time and your own place? Free . . . and relaxed . . . and just here, which could be any oat field . . . that's where we are.

Here, chew on this green, sweet stalk of oats as we stretch our legs for a long walk. See how it's hollow, like a straw. That's an oatstraw. Let the soft green sweet taste you suck from it help you remember your new friend: Avena.

We could imagine, but for the heat, that we're here in spring to see the delicate shoots of oatgrass come up out of this now-dusty earth. The earth then would be dark from rain and easily broached by the first green darts of oats. Yes, just one long, straight leaf at first, as befits a grass.

The root, at first one thin white tendril, becomes many. And the many thin fibers spread out in the earth, and down in the earth, finding what minerals are there, what water is available.

The stalk lengthens, unfurling other slender leaves, pushing upward to swing flowers and oat seeds in the breeze. That hollow, jointed stem . . . pulled away from gravity, yearning up toward the sky . . . that oatstraw . . . so graceful. Is it not the straw of connection between the earth and the sky? Let us sip and suck through it and remember our connections, and all our relations, as my Native American friends say.



First the oatgrass is as high as your knees. Then, so fast you can almost see it grow, it's as tall as your armpits, and puffing flower pollen with every breeze. The leaves grow rougher, more narrow, and pale, as the first delicate flowers appear just a few moons after the seed has sprouted.

Dark flowers they are, pendulous spikelets, swaying magically and suggestively against the pale green leaves and straws. Each tiny perfect flower forms two seeds. Each flower, wind obliging, will ripen two seeds. Two awned seeds of green that will darken until golden ripe. Two seeds that will dance looking at the earth.

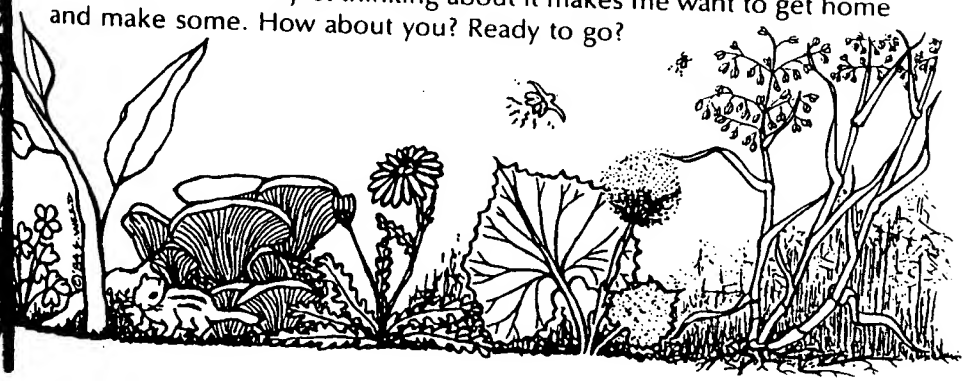
For though the oatstraw stretches to the sky, the oat herself, Avena, looks back down to the earth. Her flowers and seeds look ever back at their loving mother, and dance with their loving sisters.

This is a good spot to harvest some. We have permission to cut a bit from the edge of the field, but I feel more energy, more essence emanating from these wilder oats, the ones that aren't in the field. Maybe they really are wild oats, though most likely they're grown of some cultivated seed that the birds spread. I like the way it grows in the patterns of the earth's energy, not like the orderly rows in the field.

Come sit here with me a moment before we begin. Feel again the sunshine on your eyelids and hear the drone of the insects. Allow yourself to accept the blessing you are being given. Be blessed by each touch of the grass. Envision yourself harvesting this life-sustaining grass in a graceful way, in beauty. Ask Avena to be your ally, your friend. Wait a moment.

Yes, now we may begin. Cut an armful, no more. I only dry enough for a year, maybe two. And it's a long walk back to the car. We don't want to have too much to carry.

Back home, we'll spread this out to dry so it keeps the soft green color and a good bit of the green seeds. We don't want it to look like hay, so we won't dry it in the sun. When it's dry the stalks will snap easily. I store it, as unbroken as possible, in plain paper bags, ready to make my favorite company tea. Everyone loves the smooth taste of oatstraw. Umm . . . just thinking about it makes me want to get home and make some. How about you? Ready to go?



Oatstraw Properties and Uses

- ***nutritive,*** tonic, demulcent
- ***nervine,*** antispasmodic, antidepressant
- ***cooling,*** febrifuge, diuretic, diaphoretic, carminative

Oats and oatstraw are (for the purposes of this book) the same herb. Either the grain alone or the grain and the grass (that's the oatstraw) are **soothing** and nourishing. Regular use of either promotes a strong **nervous system** and a juicy **endocrine system.** Avena eases spasms and inflammation throughout your being, allowing engorged cells to relax, release fluid, and cool off. Oatstraw is ever ready to be your sweet sister, to give you heart, and to liven up your **love life**.

Use oats and oatstraw as a strength-giving food, a way to toughen up, a nerve tonic, a modern-day love potion, a rejuvenator, and a good friend in hot water.

- Dose of *fresh oatstraw tincture* is 20-125 drops a day, in water.
- Dose of *dried oatstraw infusion* is 1-4 cups/250-1000ml a day.

"Oatmeal made into a cake with water, baked and browned like coffee, then pulverized and made into a coffee, or infusion, forms a drink which will allay nausea and check vomiting in a majority of cases when all other means fail. . . ." Kings (1898)

***"Rasayana karma** are rejuvenative tonics; oatstraw is one. Rasayana substances rebuild the body-mind, prevent decay, and postpone aging. . . . They do not simply add to the bulk or quantity of the body, but increase its quality. [They] are more subtle, more specific, and more lasting than simple nutritive substances."* V. Lad (1986)

Oats and Oatstraw are a Strength-Giving Food

(Numbers indicate milligrams per hundred grams oats and oatstraw)

Oatstraw herb includes the green stalk, leaves, and grain. The nutritive properties of oats and oatstraw are not very different, except that oatstraw is lower in calories and higher in vitamin A (carotenes) and vitamin C than the grain alone.

Since ancient times, the hardiest people have eaten oats and honored Avena.

Consistent use of oats and oatstraw in the diet usually brings about noticeable improvement in coordination, bone density, length of attention span, balance, memory, sensitivity to pleasant stimuli, clarity of thinking, ability to perceive connections and remedy misconnections, ease of achieving meditative and conscious dream states, and overall calmness and centeredness.

Avena combines well with slippery elm (Ulmus fulva), making a particularly valuable food for convalescents, feverish children, babes who fail to thrive, anorexics, anemics, and those with weak digestion or digestive distress including ulcers, dyspepsia, chronic constipation, bleeding colitis, and gastroenteritis.

Avena is high as well in calcium (1430), iron (4.6-57), phosphorus (240-425), the vitamin B complex, including thiamine (0.4-0.7), riboflavin (1.1-1.7), niacin (1.0-4.94), folic acid, and B_6 (.08), vitamins E (5), G, and K (.18), and fiber (17.3%).

Oatstraw and oats are also a source of potassium (352), carotenes expressed as vitamin A (5045 IU), vitamin C expressed as ascorbic acid (37), and protein (5-18%), including amino acids such as histidine, arginine, tryptophane (76), leucine (501), lysine (221), phenylalanine (275), isoleucine (275), valine (319), threonine (205), and methionine (86), the "limiting" amino acid (15% supplied). Oats is one of the most protein-rich grains generally available.

Avena is quite low in calories (less than 100 per cup of cooked grain, none in the infusion) and fat (2-7).

As a mild-tasting nutritional storehouse, oatstraw and oats are ideally suited for helping the wise woman healing/wholing herself or others with chronic illness such as AIDS/ARC, Crohn's disease, lupus, or multiple sclerosis.

Plain oatmeal, or "Wild'n'Oats Cereal" (see **Oatstraw Kitchen**), or oatstraw infusion—all mellow and very pleasant tasting—are effective forms of oats, used regularly. Oatstraw tincture has less nutritive value than the cereal or infusion, and is used only occasionally.

Oats and Oatstraw Make You Tough

Avena is a tough lady and she'll toughen you up too! Let oats and oatstraw help you build strong, pliable bones, firm and reliable teeth, a stable blood-sugar level, a powerful circulatory system, sturdy lungs, and rugged nerves.

Rich in bio-active minerals, Avena is an easily digested, inexpensive source of calcium used by wise women to mend bones, build flesh, and improve circulatory and nervous system functioning. Try Avena as your ally to nourish health/wholeness/holiness during pregnancy and lactation.

If you want a daily calcium supplement, try a cup of oatstraw infusion brewed with a pinch of shave grass (horsetail herb/Equisetum arvense). Within a month you'll notice the difference in your nails, teeth, and hair, and feel it in your bones. For those with severe gum disease, make your daily brew half oatstraw and half horsetail herb.

Oatstraw baths once or twice a week, in combination with oatstraw infusion taken by the quart/liter, is part of a wise woman's way of healing those with osteoporosis, rickets, bone cancer, and broken bones.

"A tincture made from Avena sativa (oats), fifteen to twenty drops four times daily, will stimulate the brain and spinal cord." H. Santillo (1984)

Oats and Oatstraw are a Nerve Tonic

Oatstraw and oats strengthen and nourish the nerves and the nervous system. Full of nerve-cell nutrients, oatstraw helps regulate nervous system and chakra energies. The emotional and subtle bodies nervous system and chakra energies. The emotional and subtle bodies benefit amazingly from regular use, and psychic abilities often improve. By nourishing and tonifying the nerves and helping to eliminate bio-electrical resistance, oatstraw opens the nervous system to a wide range of terrestrial and galactic energies. Pain reduction is virtually always a side effect.

When I'm edgy, under stress, stretching my limits, hysterical, exhausted, beyond help, grieving, or frazzled, I dring oatstraw infusion all day and take time for my Avena meditation (page 206).

When healing yourself or others dealing with chronic tension headaches, continuous eye strain, a high-stress lifestyle, and epileptic seizures, Avena is a reliable ally. For long-term health/wholeness/holiness, merely eat or drink oats daily; in the acute phase of these tumultuous situations, include an oatstraw bath or two.

Healing/wholing from nervous breakdown, emotional breakthrough, schizophrenic episodes, convulsions, and collapse is assured when you walk the Wise Woman way of spiraling transformation and use Avena baths and oatstraw infusions as your allies. Try weekly baths and copious amounts of the infusion for as long as needed.

Oatstraw tincture and oat cakes (see **Oatstraw Kitchen**) are calming and palatable for those withdrawing from drugs (including nicotine and caffeine). Ask Avena to come and bring you ease and freedom from your distress.

Symptoms of children's nervous distress such as bedwetting, colic, allergies, and hyperactivity are relieved with regular help from Avena and your Wise Woman ways.

Oat hull pillows and mattresses are recommended for nervous, high-strung individuals, and those recovering from war or natural disasters.

Those who are sleepless due to overwrought, highly-strung nerves or leg cramps are eased by Avena. Try a cup of infusion before or with breakfast and a cup, warm, before bed. Change will be obvious in about two weeks.

Oats and Oatstraw are a Modern-Day Love Potion

Love potions go right to the heart, and so does Avena. She helps clear your blood vessels of fatty deposits and eases the beat of your heart.

Avena's ability to clear cholesterol from blood vessels is much celebrated recently. In addition to lowering cholesterol levels, a cup or more of oatstraw infusion daily (or several oatcakes for breakfast) with your other Wise Woman ways, will support and rebuild the heart muscles and circulatory vessels, and ease those with heart spasms and palpitations.

Avena helps tighten and re-elasticize your veins, eliminating varicosities and hemorrhoids, when used as a bath and a food.

Love potions also make you want to hug and kiss and more, it is said. Avena's ability to help you improve your sexual appetite and performance has been touted, praised, and sung about for centuries.

Avena's effect is not specifically aphrodisiacal. Instead, oats and oatstraw nourish the nerves, so you receive more pleasure from touching; the glands, so your juices are on the move; your heart and blood vessels so blood can circulate freely to the pelvis; and your ability to be intimate with others, so your love-making is deeply satisfying.

Less well known, but of importance to lovers, is the ability of oats and oatstraw to stabilize blood sugar levels. Large swings in your blood-sugar level can make you sleepy when the action heats up and cranky when it's time for sweet talk. Let Avena help. Diabetics and hypoglycemics, as well as lovers, find Avena a powerful ally.

Oats and Oatstraw Rejuvenate

How does Avena rejuvenate? She increases your sensory sensitivity, restores your bone and muscle mass, strengthens your capillaries, clears your blood vessels, and nourishes your hormonal and circulatory systems to optimum performance. That's how!

Alliance with Avena will give you increased energy (especially sexual energy), a glowing vigor, and remarkable skin and hair. That's rejuvenation!

Avena infusion, and to some degree the tincture, nourishes, strengthens, regulates, and revitalizes the endocrine system. Avena especially nourishes the thyroid, ovaries, and uterus.

Try a cup of infusion weekly, or 10-20 drops of tincture daily, as a preventative of prostate problems.

Women weakened and tired by childbearing, repeated pregnancies, and extended lactations find themselves feeling spry again after becoming friends with oats and oatstraw.

Regular use of Avena can help you strengthen your adrenals as well, thus helping you heal yourself or others with allergies and some menopausal problems such as night sweats.

"The pericarp of Oats contains an amorphous alkaloid which acts as a stimulant of the motor ganglia, increasing the excitability of the muscles. . . ."
Maude Grieve (1931)

Oats and Oatstraw are Good Friends in Hot Water

An evening in a hot tub with Avena is a delicious experience.

Relax in a full oatstraw bath to soothe pain from any internal distress including cystitis, pelvic inflammatory disease, rheumatism, lumbago, digestive kinks, sore kidneys, nervous debility, gout, urinary gravel, kidney stones, neurasthenia, and neuralgias. Try repeated full oatstraw baths and your Wise Woman ways to heal those who are exhausted, paralyzed, and in emotional distress, or those dealing with liver ailments, scrofula, and bone diseases.

Use a sitz bath of oatstraw to ease bladder spasms and pain, uterine pain, and chronic intestinal distress.

Use an oatstraw footbath to soak away stink, sweat, cold, and pain from your tender tootsies.

Use oatstraw washes to nourish and heal those with skin diseases, flaky or dry skin, frostbite, chilblains, wounds, and eye irritations.

For chronic conditions, take your oatstraw bath twice a week or more, and drink the infusion freely, for as many weeks as needed. In acute situations, use hot oatstraw baths and poultices frequently until pain subsides, then once or twice a day, as needed.

Oatstraw Baths

2 qts/liters oatstraw infusion	Add reheated, strained oatstraw infusion to a tub of hot water. Immerse self and soak away tensions.
	or
2.2 pounds/1 kilo oatstraw 1 gallon/4 liters water	Boil water and pour over oatstraw in a large tub. When cooled sufficiently, bathe. (Yes, with the oats and all.)

". . . thousands of tons of oat husks . . . formerly . . . used as fuel or packing material, nowadays . . . [are the] raw material from which furfural is made. Furfural is [used] in making nylon, synthetic rubber, and antiseptics."
Oxford book of Food Plants, Oxford U. Press, 1969